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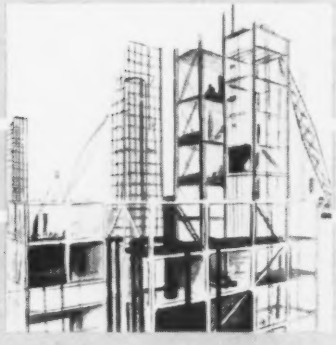

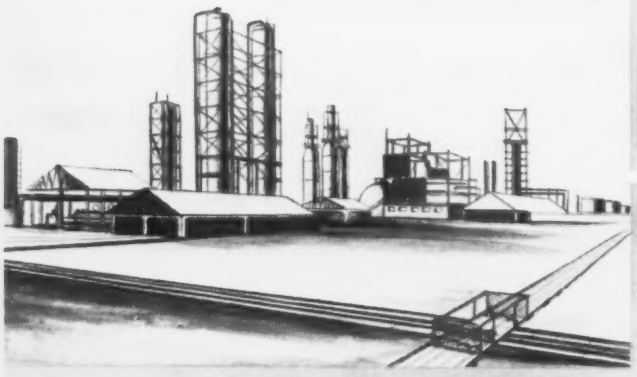

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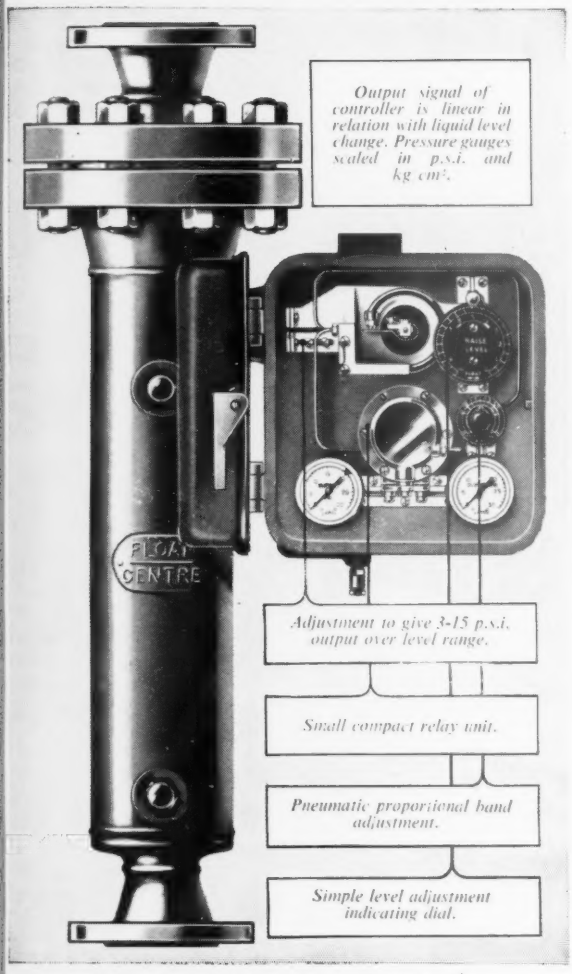
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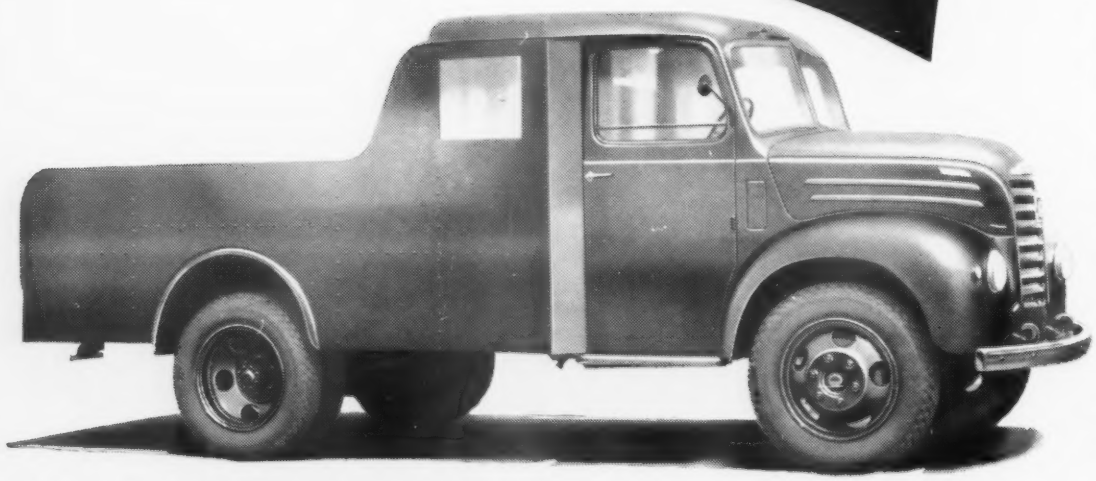

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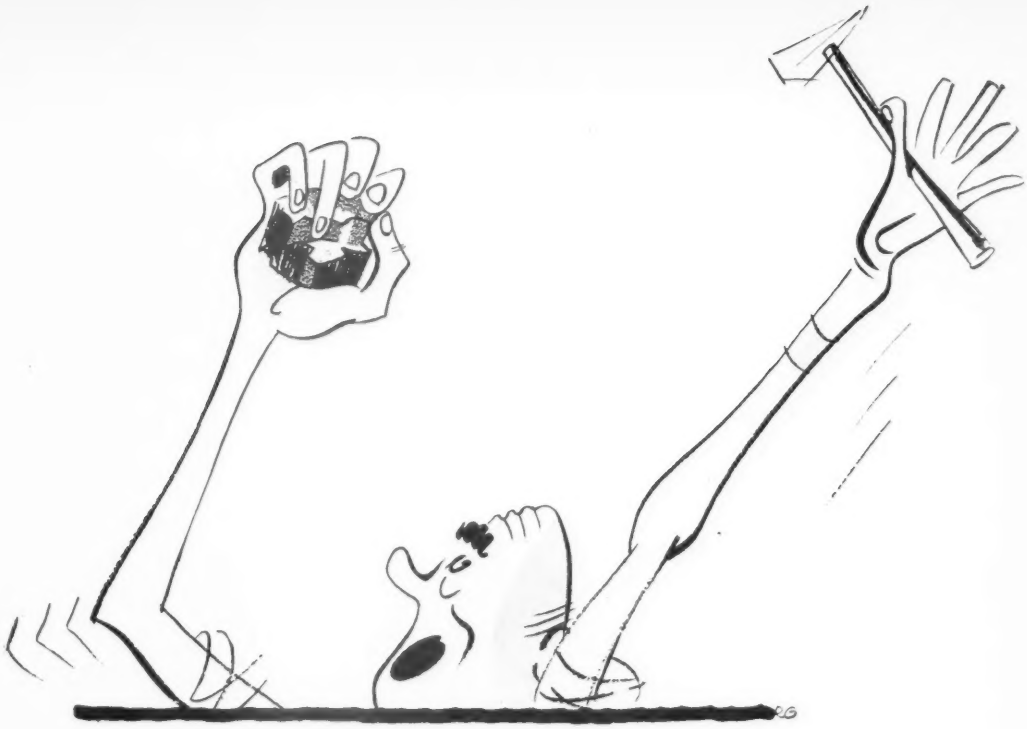

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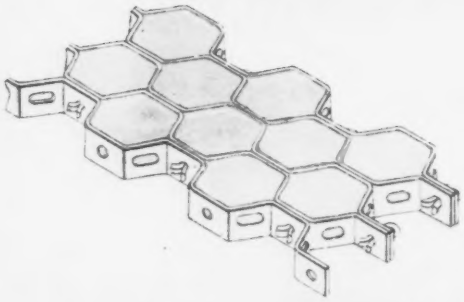

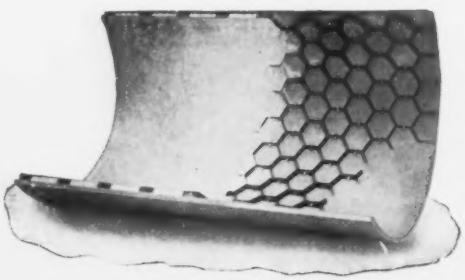

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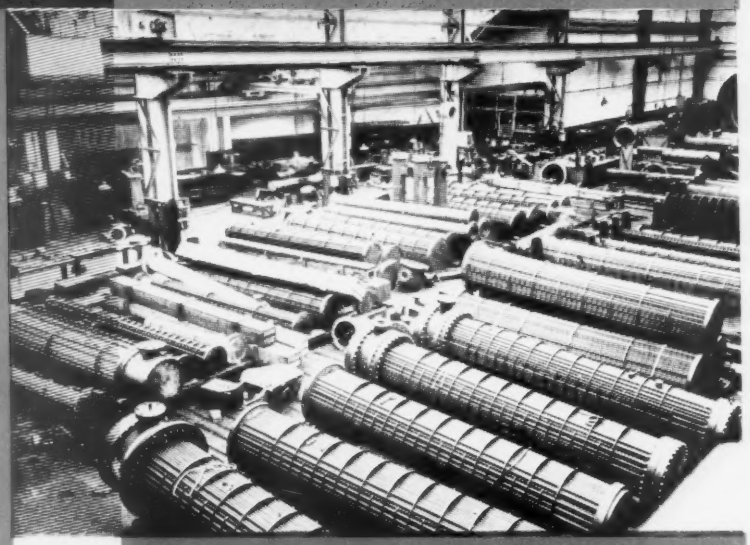

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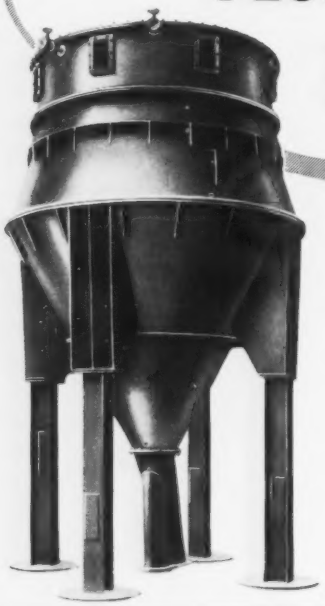

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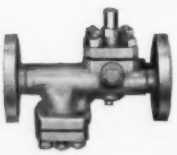

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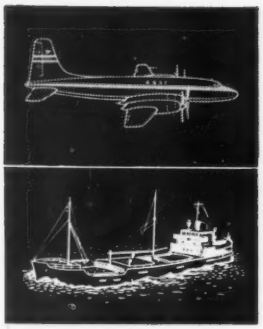

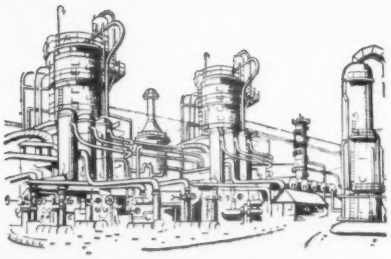

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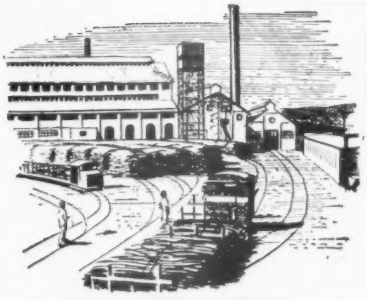

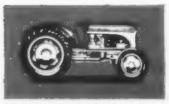

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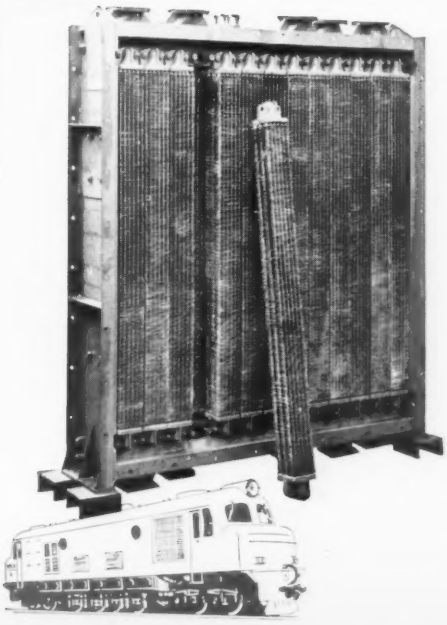

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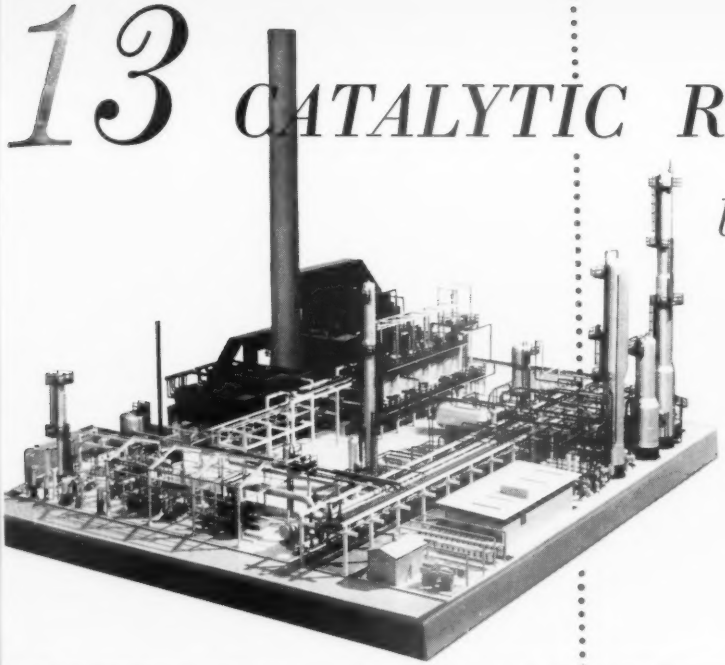

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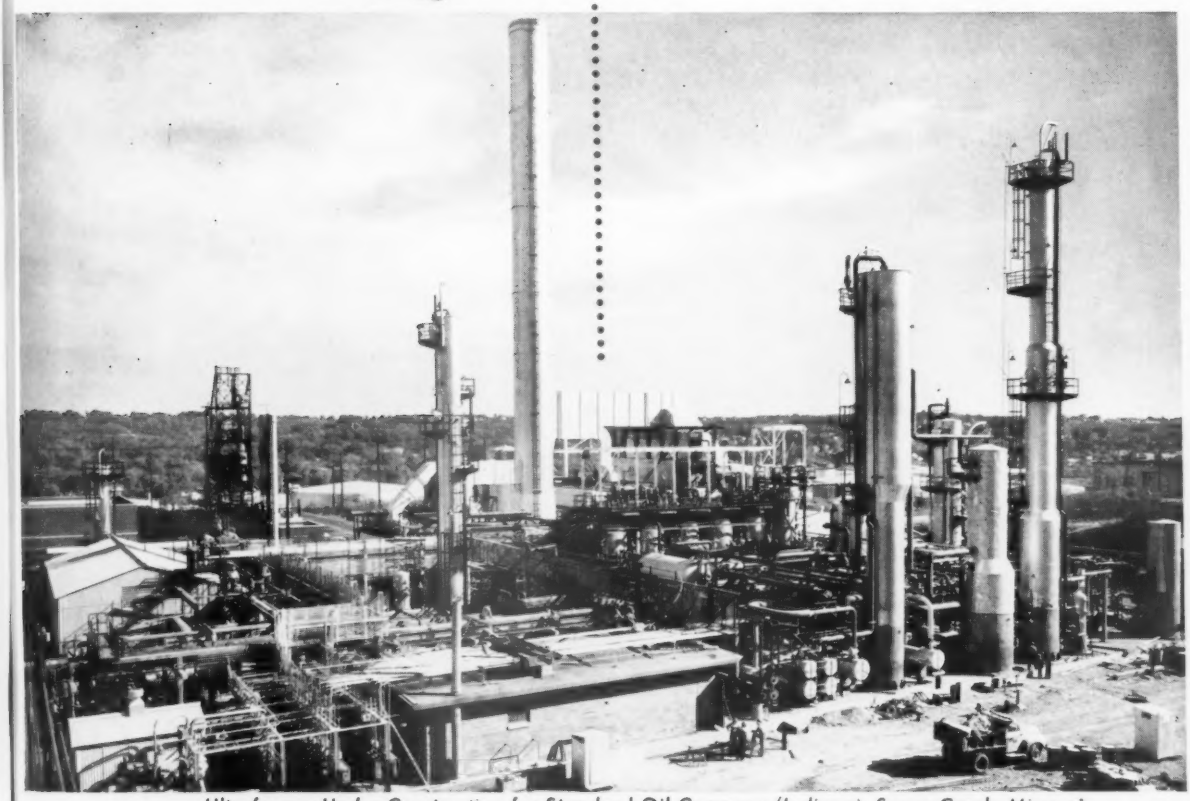

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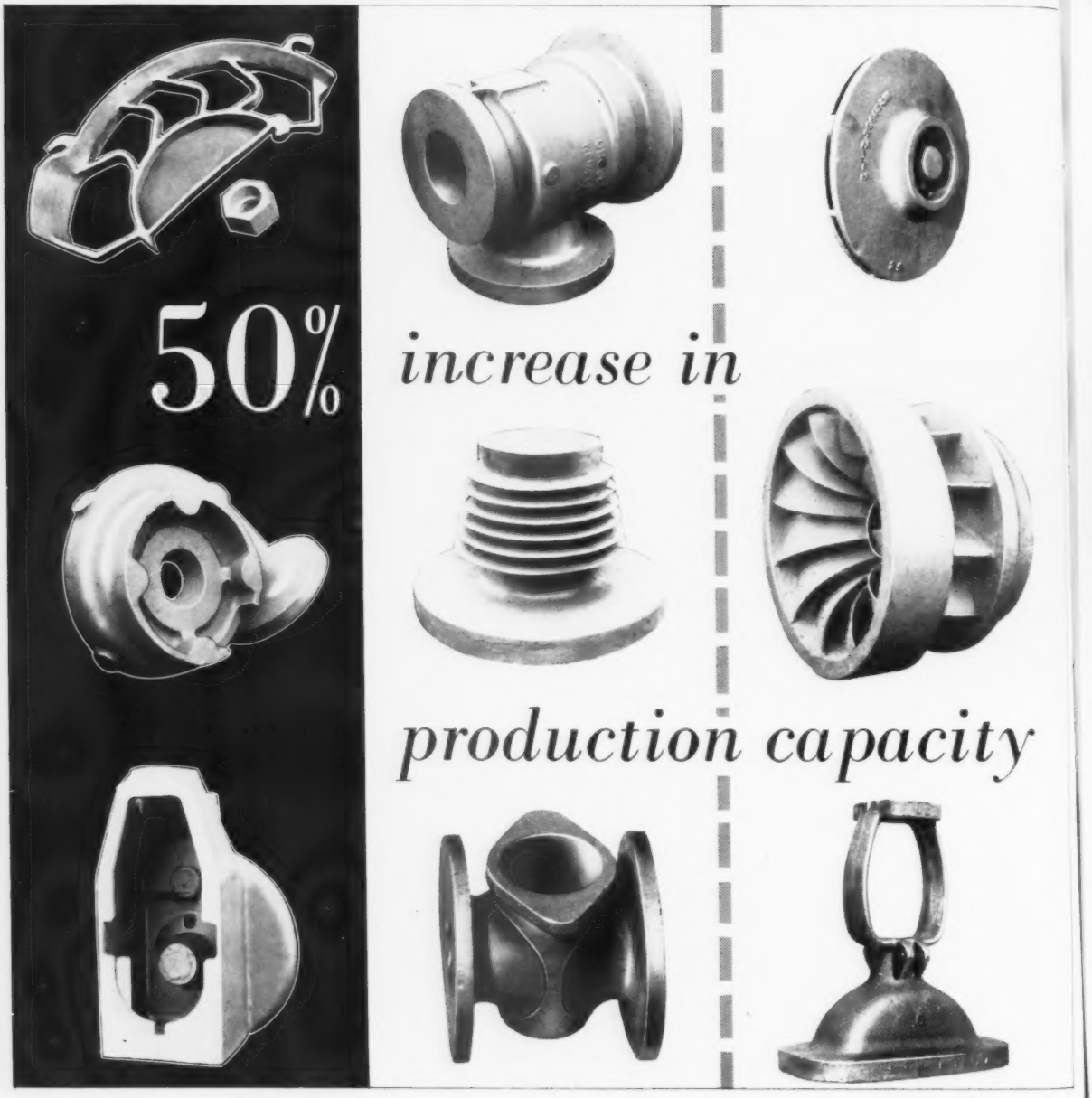

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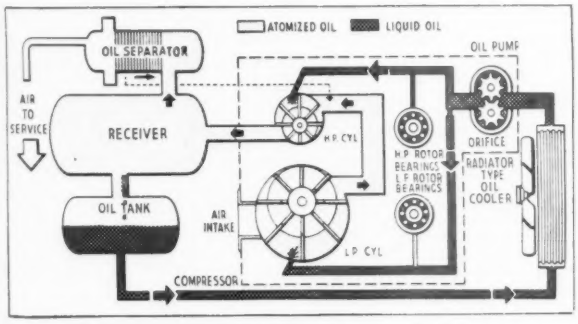

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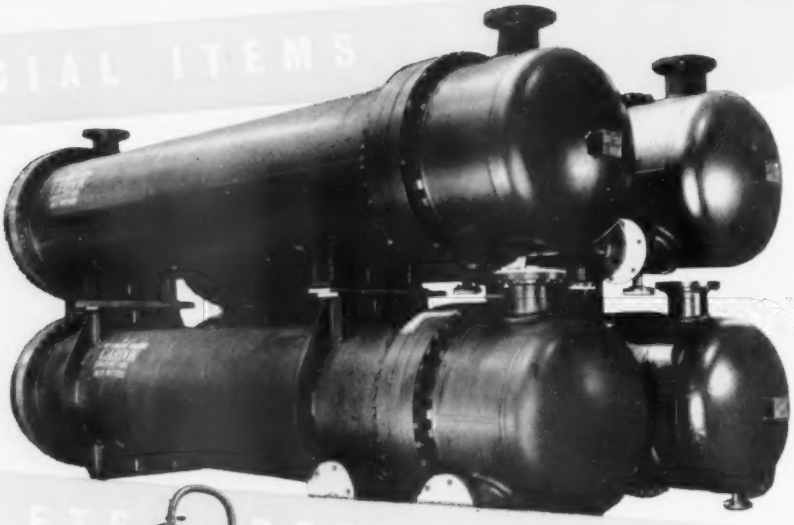

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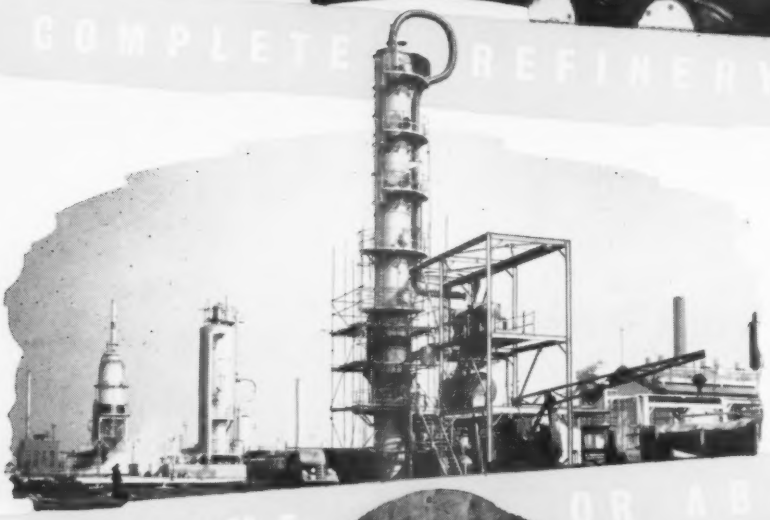

● A Platformate Splitter-column ancillary plant at the B.P. Kent Oil Refinery, Isle of Grain.

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● A Heavy-cycle Oil Stripper for Compañia Shell de Venezuela.

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The Oil Year in Retrospect

By **D. E. MILLER** *and* **K. A. D. INGLIS**

In looking at the oil year in retrospect the authors of this paper, both oil company economists, see it not from the standpoint of the refiner or geologist, of the chemist or palæontologist, but as the people concerned with supply and demand in round totals, with producer and consumer (as if they were not of either camp) and with the political and economic factors affecting the industry.

This paper was read to the Economics and Operations Group of the Institute on 8 April, 1956. Mr Miller and Mr Inglis are on the staff of The British Petroleum Co Ltd.

Demand and Supply: World

In the world as a whole and particularly in the developed areas of North America and Western Europe, which are of course the major oil consuming areas, 1955 has been a boom year, a year in which success has bred success to the point where, as we know only too well in the United Kingdom, the main problem has become one of excessive breeding. That is a subject which will be touched upon later. Industrial production in the world as a whole has increased during 1955 by nearly 10 per cent, a rate well in excess of any historical average and of the most optimistic forecasts for the future. These conditions of widespread prosperity and economic expansion have meant increased demands for energy and outside the U.S.A. the burden of this increased demand has been taken up by oil. Oil consumption in that part of the world known about in some detail (that is the world outside the U.S.S.R. and the other Communist countries), increased by 11 per cent or nearly 70 million tons over the 1954 figure, the highest absolute increase in oil demand ever and the highest percentage increase since the Korean war boom. This growth took place both in the U.S.A. where demand was 8 per cent higher and in the rest of the free world where the increase was of the order of 14 per cent. In spite of the higher rate of increase outside America, the U.S.A. is still pre-eminent as an oil producer and consumer and it is therefore necessary to examine at least briefly the trends in the country where almost three-fifths of the free world's oil is still used.

Demand and Supply: U.S.A.

After the relative stagnation that followed the inventory recession of 1954, the oil market regained lost ground and an increase of nearly 8 per cent in 1955 almost restored the U.S.A. to its post-war demand curve, a curve which implies an average increase of about 6 per cent per annum in oil demand. This high rate of increase in demand was assisted by record sales of motor cars last year when about 7½ million new vehicles were put on the road. This brought the U.S. car population to over 50 million and the vehicle population to over 60 million. Not only does this imply a vast new demand for motor spirit but it gives some measure of the extent of recovery from the 1954 down-turn when we recall the importance of the automotive industry in the U.S. economy. Industrial production rose by 9 per cent and personal incomes by about 6 per cent, a rise accompanied by no increase in the cost of living. It seems that this burst of spending income earned during boom conditions is now losing its impetus, indeed there is now the usual seasonal under-employment in the car industry. Trade in products other than motor spirit also reflected the increase in income and economic activity. There was some recovery in fuel oil trade in spite of the increased availability of other fuels, notably coal. Some losses to coal did occur—in supplies of fuel to power generating stations for instance.

The increase in U.S. demand for all oils of some 30 million tons was met to the extent of some 20 million tons from indigenous production and by an increase in imports of some 10 million tons.

The question of imports, which were some 19 per cent greater than in 1954, has caused a certain amount of concern in the U.S.A. since the ratio of imported oil to domestic output has been growing. This question, in fact, became the major industry topic during the year. In February the Cabinet Fuels Committee issued its report on the question and suggested that the relationship between domestic production and imports should be maintained at the 1954 level. The level proposed in this recommendation was tacitly accepted by the industry as the basis for 1955 imports. Nevertheless, imports continued to grow faster than domestic production. In October Dr Flemming, the

Director of the Office of Defence Mobilization, following protectionist pressure from independent domestic oil producers and from other pressure groups, called upon the importing companies to reduce imports from areas other than Canada and Venezuela by 7 per cent and so bring them in line with the recommended levels by early 1956. At present the success of this appeal seems to be rather limited. In spite of this fact, the indications are that the new report by the Office of Defence Mobilization will involve no abandonment of the principle of control "by voluntary, individual action of importers of crude or residual oil". Is this import limitation feasible and is it likely to continue?

It seems that in the long run the ratio is going to become more and more untenable. Demand in the U.S.A. is expected to rise over the next few years at some 2½-3½ per cent per annum. If the Cabinet Committee recommendations are to be followed, production must rise at the same rate. Such an increase infers that by, say, the mid-1960s the U.S.A. will be required to produce some 500 million tons, a figure which some authorities consider to be unlikely as long as a reasonable ratio between reserves and production is maintained. From this it would seem that an increase in the ratio will be necessary by that time if not before. In addition there are other significant factors. 1955 saw an increase in the number of U.S. independents operating overseas. In the Middle East in particular there was a considerable widening in American participation with the entry into the Persian Consortium of the nine American companies forming Iricon. This increase in the number of American companies interested in exploration and production outside the U.S.A. should tend somewhat to alter the lobby bias—in favour of a slackening of import restrictions. Secondly, although strategic considerations may favour protectionist policies, or perhaps Western Hemisphere self-sufficiency, liberal trade policies, if they are to mean anything, must be opposed to the imposition of quotas.

Demand and Supply: Rest of the World

Outside the U.S.A. demand increased by 14 per cent or about 38 million tons. The major area of consumption was Western Europe and its increase of 17 per cent accounted for about 17 million tons of the total increase in the rest of the world. Elsewhere large percentage gains were recorded and whilst there were variations, most of the other major demand areas returned increases of over 10 per cent. These gains followed substantial growth in 1954 but it is probably fair to say that 1955 in most cases surpassed them. What were the determinants of this buoyant demand? In all cases, though in varying degrees, the two major factors were the high rate of economic and industrial development and the shortage of other forms of energy. The relative importance of these factors is on a world-wide basis approximately equal; that is to say 50 per cent of the growth in oil demand is attributable to the normal growth in the demand for energy, while the remaining 50 per cent increase is attributable to the shortage of alternative fuels.

As has been stated 1955 was a highly prosperous year but the general conditions of full or over-full employment produced a degree of inflation or a threat of inflation throughout America and Western Europe which called for widespread deflationary measures. These took the form of both physical controls and control on financial credit. The measures seem to have taken effect—although in the United Kingdom a second dose has had to be administered in recent months. The question arises as to whether this was the culmination of a boom period, fostered by the absorption of refugee and under-employed labour and bolstered up by the post-war reconstruction and building. In the future, it seems likely that increases in output will be entirely dependent upon increases in population and productivity and the re-allocation of manpower, and are likely to be at levels below those experienced during the years since 1946. Moreover, the achievement of these higher levels of productivity is likely to be retarded in the near future by restrictions upon capital investment.

The second major factor—the shortage of other energy sources—has made itself felt mainly in Europe and those areas dependent upon the export of European coal. With the rapid growth of national incomes and industrial production and also with the redistribution of national income there is an associated growth in energy demand. After the initial post-war period it was hoped that coal would be able to resume its traditional rôle and keep pace with growing energy demands. This, however, has not been the case and the growing energy gap so created has been the subject of much concern during 1955. Although certain local surpluses occurred in 1954 in countries such as Belgium and France, which involved stock-piling or a cut-back in production, these were absorbed in Europe as a whole in 1955 and the volume of imports from outside the European area rose steeply to a level of almost 30 million tons, the vast bulk of which has had to come from the United States of America—at high cost to dollar-short countries.

During the last year or two optimism about increasing coal output has been fading. The U.K. coal industry now seems to be expecting very little expansion in output and similar conditions apply in Germany and Belgium. In the countries of Europe other than the U.K. the increase in coal production in 1955 was just over 1 per cent while in the United Kingdom there was a decline of almost 1 per cent. Growing imports of U.S. coal seem to be the prospect facing the countries of Europe, a fact accepted by the European Coal and Steel Community which foresees imports of 30 million tons of American coal in the near future, rising perhaps to 50 or 60 million tons. It does seem therefore that oil will continue to meet increasing energy demands which would traditionally have been met by coal and that this feature was not merely a function of post-war reconstruction. Although this analysis applies with greatest point in Europe, it is equally applicable elsewhere.

The growth of non-traditional demand tends to fall on black oils, a tendency strongly brought out last year when the demand for gas, diesel, and fuel oils in the Eastern Hemisphere increased by about 16 per cent as against an increase of only 9 per cent in motor spirit. The discrepancy in Europe was even more marked; inland trade in fuel oil was over 20 per cent above the 1954 level whereas the growth in motor spirit trade was at less than half that rate. Bunker trade, which tends to have a dampening influence on inland trade, was particularly buoyant, reflecting a large increase (of about 8 per cent) in the volume of world trade. Conversion of motor ships to fuel oil burning and the fact that most new motor vessels are equipped to burn heavy furnace oils has meant a more than proportionate increase in the demand for these fuels.

This disproportionate demand for fuel oil seems likely to continue, although as oil takes up an increasing share of total energy demand the rate of growth will tend to flatten

out. As increases in oil consumption approximate to increases in total energy demand, the tendency will be for the growth rate in black oils to fall below that of motor spirit. This will, however, be in the very long run and in any case the product pattern may have become so altered by then as to bear little resemblance to demand as we know it today.

A pointer towards the continued strong demand for fuel oil is to be seen in the anticipated requirements of the Central Electricity Authority in the United Kingdom. By the signing of contracts within the last 18 months, the Electricity Authority (and presumably the Coal Board) have recognized that coal supplies in the U.K. are not going to be adequate to meet all needs. A similar position is arising in Germany which although the major coal producer on the Continent had to import 7 million tons of coal from the U.S.A. last year and is currently importing American coal at a rate of 11 million tons a year. In Germany there has been some easing of the taxation on oil products and the demand for heavy fuel has increased at a quite remarkable rate. Another factor affecting future demand for black oils was introduced when plans for the partial dieselization of the railroads in the United Kingdom were announced. Railway requirements have for many years been a strong supporting element of middle distillate demand in the United States of America and Canada where road dieselization has made little if any progress. In Europe, however, this new market for diesel oil may further distort the relative demand for motor spirit and diesel fuel, a distortion already induced by taxation policy in the United Kindom and on the Continent.

Against the background of this basic change in product pattern, there have been some significant developments during the last year or so. The civilian service of turboprop airliners has been established and the potentiality of the straight jet airliner was reaffirmed by the round-the-world trip of the Comet III and the flight to London of the T.U.104. These developments accentuate the gradual changeover from piston-engine to turbine-engine civil aircraft which will mean increased offtakes of middle distillates—if the present fuels are to be used. Similarly, several of the gas turbine cars which were the subject of trials in 1955 are designed to burn middle distillate fuels. These possible changes are to some extent offset by the use of light liquid hydrocarbons in the manufacture of town gas in catalytic reforming units which are being built in increasing numbers on a global basis. Some adjustment of refinery yield to product demand may also be achieved in installations such as the gas plant to be built close to the Kent refinery by the South Eastern Gas Board. Another developing use for the lighter fractions is in the petrochemical industry. Demand for chemical products derived from petroleum showed customary large increases during 1955 but the size of this outlet is likely to remain small compared with the rapid growth in demand for fuel oil. Even if the demand for chemicals continues to grow at a rate of about 15-20 per cent per annum, it will still contribute only about 1 per cent of the total world demand for oil in 10 years' time.

A partial answer to the possibility of light fraction surpluses and a deficiency of fuel oil has been achieved by the continued installation in refineries throughout the world of naphtha reforming units in preference to catalytic crackers to obtain higher motor spirit quality.

Prices and Freights

One effect of the increased demand for fuel oil was an increase in price. In two stages heavy fuels increased from $1.85 to $2.10 per barrel and this increase was reflected in gains in the price of heavy export crudes. This price change was almost certainly a result of the high level of demand in Western Europe and did not directly reflect the U.S. demand-supply position. This is the first large increase in fuel oil prices for several years although there has been a sustained trend towards a closing of the gap between gasoline and heavy oils. Moreover, the world price of oils has not risen as fast over the last few years as has that of coal. It seems inevitable that if refiners are to maintain a margin, black oils will have to carry an increased proportion of refining costs and there must therefore be some continuation of the tendency for the relative prices of products to narrow. Other than this and normal seasonal fluctuations, product prices remain fairly stable notwithstanding a general rise in commodity prices. It is true, however, that as motor spirit quality is improved the marginal cost of increasing that quality by a further octane number rises, a fact which is reflected in the larger price differential between 90 and 95 octane fuels than between 80 and 85 octane fuels.

The increase in demand had another effect—it brought about a sharp increase in tanker freights. At the beginning of 1955, and, in fact, until September, freights were little above the depressed levels of 1954 when there were about four million tons of shipping laid up in the slack season. The rate of scrapping continued high and many tankers were converted to dry cargo. Furthermore, new deliveries were nearly 30 per cent lower than in 1954. In the autumn, demand for tonnage was higher than anticipated and rates soared to their highest level since 1951. Although the rates have now eased, they still remain higher than a year ago.

Transportation

The recovery in freight rates and the expectation of continually expanding oil markets were undoubtedly among the factors which re-awakened interest in tanker orders and building. Thus, although the ratio of tanker buildings to total buildings is now comparatively low—for example it dropped from 50 per cent in December 1954 to 41 per cent in December 1955 in United Kingdom yards—new orders have increased greatly over the last six or nine months and it is difficult to obtain berths for new buildings up to 1961. The average tonnage of tankers in service has also continued to increase—and a peak of 84,000 tons is suggested by reports of two such monsters being ordered in Japan for American companies.

The use of 45,000-ton tankers for crude hauls out of the Middle East and the necessity of their seeking passage in partial load through the Suez Canal have shown that the Canal's capacity has been surpassed in terms of draught if not in terms of transits. Even so, the major contribution which the Suez Canal makes towards meeting Western Hemisphere energy needs can be seen from the fact that 67 million tons of oil passed through the Canal from South to North in 1955. We cannot, however, ignore the possibility that the Canal may exist as a double bottleneck in the near future—in terms both of draught and of transits.

Nuclear Energy and the Oil Industry

Concern over future energy supplies (of which the Suez Canal problem is merely one aspect) reached its peak at

the Geneva Conference on the Peaceful Uses of Atomic Energy. Many assessments were made both of the present and future energy situations and much attention was paid to the methodology of arriving at forecasts. In most cases not very elaborate assessments were made. In Europe both O.E.E.C. and the member governments of E.C.S.C. have been taking an increasing interest in total energy problems. Both have set up committees to assess European energy needs and in the case of the Luxembourg Powers to discuss means of integrating these sources of power. Both authorities are considering how to co-ordinate the European effort in the field of nuclear research for both war and peace. Although this research and study has been stimulated by an interest in nuclear developments, it is likely to have a more immediate impact upon the oil industry than upon any other of the energy supply industries.

At the Conference, informed assessments of the potential contribution of nuclear energy to the world's energy requirements within the next 25 and the next 50 years were made, and it became apparent that until the end of the century the atom could be looked upon as an essential complement to rather than as a competitor of the conventional fuels. Only in the highly industrialized countries of Western Europe, dependent upon high-cost energy sources, could nuclear energy make more than a very minor contribution. Moreover the capital effort, industrial structure, and the body of technical personnel required for a full-scale development programme are so sizeable that it is doubtful whether any European country could "go it alone". Thus, the United Kingdom has at present restricted its large-scale development to two types of reactor—the basic proved prototype at Calder Hall and the highly complex fast breeder at Dounreay. Research on intermediate types of reactor is at present only being conducted on a pilot plant laboratory scale at Harwell. While under-developed countries, in Asia and Africa particularly, are crying out for a new relatively cheap source of energy, they almost without exception lack the three basic essentials mentioned and are likely to remain dependent upon outside aid for any development in this field. In the United States of America where more intensive research is going on than anywhere else, production costs will have to be cut by over 50 per cent before electricity from a nuclear pile can compete on any scale with conventionally generated electricity or other fuels.

All nuclear research programmes benefit in matters of finance, facilities, and personnel, from the dual purpose of their results—knowledge equally valuable in war and peace. Thus, the fields of aircraft propulsion and ship propulsion, which would appear on first examination to be inappropriate applications of nuclear techniques, are receiving a great deal of attention and although it was stated at Geneva that marine unit costs were in the ratio of 6 : 1 against conventional installations, intensive research on both sides of the Atlantic, in the U.S.A., U.K., and Norway, may close the gap more quickly than was anticipated. Were this to occur in the fields of both aircraft and ship propulsion (and at least rude prototypes have been in trial operation) the impact upon the oil industry would be very marked indeed.

Even before the Conference, no industry was more active in utilizing nuclear techniques than the oil industry. This interest has sharpened, however, since Geneva; in America, oil companies have taken the lead in acquiring nuclear equipment and building laboratories to assist in research into exploration, material and wear testing and refining—although little is known of what may emerge from the third application, it may well prove the most dramatic of all.

Oil Supply in the Future and the Importance of the Middle East

It is apparent that whatever the contribution of nuclear energy and other fuels, oil will be called upon to bridge the gap in energy supplies. Perhaps in response to this concern, interest in oil reserves seems to have increased throughout the year and has culminated in Wallace Pratt's estimates, well in excess of any other. On two points all are agreed—that there are ample supplies for the foreseeable future and that the balance of reserves has swung strongly to the Middle East. We are all aware of Europe's current dependence on Middle East supplies and have discussed the likelihood of the United States' growing dependence. The Middle East published proved reserves are now about two-thirds of total world reserves. Last year in face of the increase in the world's demands of some 11 per cent Middle East production increased by 18 per cent, a rate surpassed only by Canada—whose production is, of course, still small by world standards. Whilst on the subject of figures it is interesting to note that about half the oil moving in international trade had its origin in the Middle East area. Our politicians, diplomatists, and soldiers have been much concerned with this area during the last year, and suffice it to say at present that in the areas of major interest to the oil industry, the unrest of the past year has not affected the producing nations, but only those devoid of oil supplies in bulk but interested in its transportation. No review of the oil year could omit a mention of developments in the area but the details of Britain's interest in and relations with Cyprus, Egypt, Israel and Jordan, Syria and the Lebanon, Saudi Arabia, and the members of the Baghdad Pact and the incidents connected with them in 1955 are all too well known to require discussion or elaboration in the context of this paper.

Conclusion

As economists the authors have endeavoured to pose questions on the basis of the facts as they see them and leave it to the geologists, refiners, diplomatists, and other experts to resolve them.

To sum up, it might be said that there were two major factors affecting the oil industry in 1955. Firstly, there was a growing awareness throughout the world and in Western Europe, in particular, of coal's inability to meet demands in its traditional sphere and an attendant realization that fuel oil must meet the shortfall in coal production for at least the next twenty years. Secondly, the tremendous potential of nuclear energy, in spite of its being immediately competitive in many European countries with conventional fuels, cannot be expected until after 1975 to play any but a minor part in energy supply. Oil will be called upon to supply an ever-growing proportion of the world's *basic* fuel requirements for another twenty years and may thereafter be at least partially liberated to meet demands where its peculiar properties can be put to better use than as a mere replacement for coal. If this is an accurate forecast of the future, 1955 may be looked back upon as the year in which these two periods of development in the history of the oil industry became clearly discernible.

Lubrication in Theory and Practice

The Manchester Symposium

The subject of lubrication can always be expected to draw a record gathering at any meeting for which it is announced. Therefore, it was no surprise to the organizers of the Symposium on Lubrication in Manchester on 19 April that the Chemistry Lecture Theatre was occupied by nearly 300 people from 10.30 a.m. to 6.30 p.m.

For several years now the local branches of The Chemical Society, The Institute of Petroleum, The Royal Institute of Chemistry, and The Society of Chemical Industry have organized a joint symposium annually. This year it was the turn of the IP to act as sponsors and it is obvious that the choice of subject was a wise one.

Theory and Application

The morning session was under the chairmanship of Professor G. Gee, F.R.S., and opened with an address by Dr J. W. Menter, of the Research Laboratory for the Physics and Chemistry of Surfaces, University of Cambridge. He dealt with the friction and lubrication of solid surfaces in a masterly fashion, illustrating his remarks with many diagrams.

Dr F. T. Barwell, of the Mechanical Engineering Research Laboratory, Thorntonhall, Glasgow, then discussed the application of hydrodynamic lubrication to bearing design. In particular he described work which was being carried out at MERL to elucidate the factors necessary for the design of high-speed bearings. In this work, transparent bearings are used and the lubricant is illuminated by ultra-violet light. In regard to lubricant materials, Dr Barwell concluded that "there is little doubt that petroleum will remain the major basis for the production of lubricants, and any study based on its application will be of lasting value".

Solid Lubricants

The first two papers in the afternoon session, presided over by Professor Frank Morton, of the Manchester College of Technology, concerned solid lubricants.

At the Manchester Symposium: (left) *Dr F. T. Barwell, Prof G. Gee, E. A. Evans, and Dr T. Mastin;* (centre) *G. H. Thornley (Chairman of IP Branches Committee), Prof Frank Morton, G. M. Davies (Chairman of IP Northern Branch), Prof E. S. Sellars, and H. Kaye (Hon. Secretary of IP Northern Branch);* (right) *the "Shell Research" team—V. W. David, J. R. Hughes, and D. Reece discuss lubrication problems with the IP President, Col S. J. M. Auld.*

For an hour Dr T. Mastin was at the blackboard answering questions on the action of additives.

The first of these papers was by J. W. Midgley, from the Applied Physical Chemistry of Surfaces Laboratory of Imperial College, London. He discussed the frictional properties of molybdenum disulphide and reported experiments on unbonded natural MoS_2 films which showed that their frictional resistance decreased with their increased dryness. The practical significance of this was discussed and compared with known characteristics of graphite.

This speaker was followed by E. A. Smith of Acheson Colloids Ltd, who discussed the subject in general terms with specific reference to graphite. He also made some reference to the lubricating possibilities of molybdenum disulphide, glass, talc, mica, camphor, etc. He concluded that "before long one may be able to tailor-make a structure in a solid to provide special features in much the same way as the oil technologist can now assemble his closed and open chain compounds for liquid lubrication".

At the Manchester Symposium: E. J. Dunstan, J. E. Haslam, and Dr T. Mastin.

Gas Turbine Lubrication

The final paper of the afternoon session was devoted to the lubrication problems of aviation gas turbines, the authors being V. B. David, J. R. Hughes, and D. Reece of the Thornton Research Centre of "Shell" Research Ltd. They showed that the load-carrying capacity of synthetic lubricants and, in general, oils with EP additives, decreases with increasing speed. They concluded that mineral oils, though having some low temperature limitations for gas turbine use, are not so bad as their pour points would indicate provided minimum oil temperatures are not lower than -30° C.

Additives and their Action

The evening session, 5.00 to 6.30 p.m. was entirely devoted to C. V. Smalheer and Dr T. W. Mastin, of the Lubrizol Corporation, Cleveland, Ohio, and the chair was taken by Lieut-Col S. J. M. Auld, O.B.E., M.C., the president of the IP. The paper, which was presented by Dr Mastin, outlined the history of the development of hypoid gear and HD detergent oils in the U.S.A. He stressed the importance of full-scale test procedures in development work and discussed the chemistry and mode of action of the detergent additive.

This paper was particularly noteworthy for the lengthy discussion which followed its presentation. For an hour Dr Mastin was assailed with questions and at no time was he at loss for a reply or an explanation. The blackboard was more than once filled with chemical formulæ to amplify a point made by the author.

At the conclusion of the meeting Colonel Auld expressed his thanks to all concerned in the day's proceedings—to the organizers, to the authors of the papers, and to the chairmen of the two preceding sessions.

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WELDING CONFERENCE

A British Commonwealth Welding Conference, organized by the Institute of Welding, is to be held in London and Saltburn-by-Sea from 17 to 29 June 1957.

The aims of the Conference are to exchange information on the present technical position of the welding processes and their main applications within the Commonwealth, to consider means of improving the exchange of technical information about welding among the countries of the Commonwealth, and to emphasize the importance of the contribution which welding can increasingly make to the development of modern engineering productions.

Further details can be obtained from The Secretary (CWC), The Institute of Welding, 2 Buckingham Palace Gardens, London, S.W.1.

Around the Branches

BAHRAIN, FAWLEY, KUWAIT, LONDON, NORTHERN, SCOTTISH, SOUTH-EASTERN, SOUTH WALES, STANLOW, TRINIDAD

London Branch

On 20 March the Branch received an address from the President of the Institute entitled The Internationalizing of Petroleum Technology. This was followed by a lively discussion which reflected the great interest shown in the subject.

A vote of thanks was proposed by the Chairman, W. H. Davies, who expressed the Branch's thanks to the President for an extremely interesting evening.

South-Eastern Branch

A successful season was concluded with two lectures of exceptional interest. The first, on 3 April, was by the Chairman of the Branch, Dr J. E. Carruthers, F.Inst.Pet., who chose as his subject "Methods of Testing Petroleum Products", and illustrated his talk with experiments using both orthodox and also some unorthodox apparatus. The meeting was enlivened by flashes, flames, and bangs at the right times, as the significance of flash points and tests for explosive vapours was explained. Viscometry was dealt with in a variety of demonstrations, tracing the evolution of the modern temperature-controlled kinematic viscometer from the simple forms, and also the development of viscometers relying upon the measurement of the resistance offered to rotating surfaces. An interesting discussion followed the paper.

The second meeting on 1 May, was addressed by Captain J. J. Nesbitt of the British Tanker Company. Speaking on the subject of "Oil Tanker Operations" to an audience of about 60 members and friends, he covered the subject from a variety of different angles, returning frequently to give "a breath of the sea" from his own experience. Discussion would have gone on longer had the time permitted, and Captain Nesbitt was plied with questions informally during the interval for refreshments. A trio of films "We've Come a Long Way", "Tanker Story", and "s.s. *British Sovereign*" brought the evening and the present session to a very satisfying conclusion.

Preparations are well in hand for a series of summer visits, and the programme for the forthcoming season is being prepared.

Trinidad Branch

At the 152nd general meeting of the Branch, Mr Leavitt reviewed the various methods of evaluating a crude by distillation into fractions of various boiling ranges which could be tested for such properties as octane number, diesel index, sulphur content, etc. Beginning with the simple ASTM distillation, other more precise and larger-scale distillation procedures were discussed. Mr Leavitt showed how from these a complete picture of the crude oil could be obtained indicating to the refinery the optimum conditions for processing the crude to the best advantage together with the yields of each product that could be expected.

In the field of gas analysis, the simple Orsat method was mentioned and the trend to highly accurate and complex methods such as Podbielniak analysis, mass infra-red, ultra violet, Raman and emission spectroscopy was reviewed. A more recent tool, that of vapour phase chromatography, was based on chromatographic experiments by F. F. Runge in the 19th century, said Mr Leavitt, and was already finding wide application in the analysis of gas mixtures.

The Dart Engine

On 23 March, N. Smith of Rolls Royce Limited, the manufacturers of the Dart engine which powers the Vickers Viscount aircraft, gave a lecture on the operation and construction of this engine.

After a short introduction on engine performance, Mr Smith discussed the mechanical details of the Dart 506 engine. The basic idea of the turboprop engine is extremely simple, consisting of a compressor forcing air into a combustion chamber at high pressure and a turbine to recover power from the hot exhaust gases to drive the compressor and the propeller. The engineering problems of such an engine are, however, not in the least simple.

First, there are very high temperatures, up to 2000°C, in the combustion chamber and this makes it very difficult to avoid distortion and failure of the working parts. Bearings are carefully insulated from the hot parts of the engine and even the flame tube in the combustion chamber itself is protected by making a thin layer of cold air flow across its surface.

Secondly, the speed and power output of the turbine is very high, in fact the turbine produces three times the rated output of the engine, 1400 h.p. The rest of the power is, of course, required to drive the compressor. Very careful design is required to avoid destructive vibrations in the turbine at the take-off speed of 14,500 rev/min.

Thirdly, there is the wide variety of accessories required to supply the engine with the correct amount of fuel under all possible operating conditions and to ensure that if any part of the engine does fail further damage to the engine is prevented. There are devices which prevent overspeeding, give warning when the fuel filters ice up, reduce the propeller drag if the engine fails, shut down the engine if it loses power and a host of other safety features. It was a great tribute to Mr Smith's ability as a lecturer that he managed to give such a clear and interesting description of the complexities of a modern gas turbine engine in a short lecture.

Personal Notes

A. M. Holbein has resigned from the managing directorship of D. & C. and William Press Ltd in order to give sufficient time to the Federation of Civil Engineering Contractors, of which he has recently been elected President. He will, however, remain an active director of D. & C. and William Press and of Demolition and Construction Ltd.

A. Morrison, M.I.Mech.E., who joined the Company from the Anglo-Iranian Oil Company in 1952, has succeeded as managing director.

J. H. Buscombe, general manager—Finance and Accounts, has been appointed a director of Shell-Mex and BP Ltd on the retirement of **F. A. Keeling.** He has assumed full responsibility for the financial and accounting affairs of the Company.

J. H. Buscombe

Mr Keeling began his career in the oil industry in 1917 when he joined the Asiatic Petroleum Company Ltd. After serving in the first world war he was employed in Egypt and later in Cape Town. Mr Keeling joined Shell-Mex and BP Ltd in 1941 and became joint chief accountant in 1942. In 1946 he was made chief accountant and in 1951 controller of accounts. He joined the Board as Director—Finance in 1954.

Mr Buscombe joined the Royal Dutch/Shell Group at the end of the second world war. After serving in the Legal Department he was engaged on Group programming as assistant to the Head of the Production Department. He later took charge of this unit and served as secretary of the Finance Committee of the managing directors. Mr Buscombe became assistant to the Head of the Finance Administration in London on its formation in 1953. He joined Shell-Mex and BP Ltd as general manager—finance and accounts in 1954.

Air Chief Marshal Sir John Nelson Boothman, K.C.B., K.B.E., D.F.C., A.F.C., F.R.Ae.S., has joined the Board of Kelvin & Hughes Ltd.

Congratulations to **Jonkheer H. G. A. Quarles van Ufford** on his being made an honorary C.B.E. by Her Majesty the Queen for valuable assistance in connexion with the Airborne Division pilgrimages to Arnhem. He is Queen Juliana's Commissioner for the Province of Gelderland and during the war was Burgomaster of Apeldoorn. Members of the petroleum press will remember with much pleasure the excellent arrangements which his committee made for them during the Third World Petroleum Congress in The Hague in 1951. Until his retirement about two years ago he was in the public relations department of the BPM.

J. C. C. Taylor, who recently retired after 25 years service as aviation sales manager of Shell-Mex and BP Ltd, has been appointed aviation sales consultant to The British Petroleum Co Ltd.

Mr Taylor joined the former BP Company in 1923 and helped to form the BP Aviation Service. He was responsible for the first aircraft re-fuelling system in the U.K. to use large-capacity vehicles. When Shell-Mex and BP Ltd was formed in 1932 Mr Taylor was transferred to that Company.

Whessoe Ltd has recently anounced the appointment of **R. F. Bishop,** M.A. (Cantab), A.M.I.Mech.E., as chief engineer (Special Developments) and of **D. S. Hudspeth,** B.Sc., A.M.I.C.E., as chief engineer (Petroleum Equipment).

In recent years Mr Bishop has been responsible for advanced development and design of heavy pressure vessels and other structures for nuclear power and aeronautical research test facilities. Mr Hudspeth has been concerned with evaporation saving equipment (notably Horton floating roofs) and with instrumentation associated with the storage of volatile products. In his new position he will be responsible for all aspects of Whessoe petroleum equipment work.

S. V. Jackson, who has been a fuel engineer in the Fuel Efficiency Branch of the Ministry of Fuel and Power since 1948, has been appointed chief engineer of Hubbard Combustion Ltd.

G. J. Flatow, Dipl.Ing., A.M.I.Mech.E., A.F.Inst.Pet., and **H. N. Wigan,** M.C., M.Inst.Pet., directors of Amber Chemical Industries Ltd, have recently been concerned with the re-organization and expansion of their Company's activities.

Increased production of industrial cutting oils and of specialized and general purpose oils will result from this expansion and a new company, Amber Oils Ltd, has been formed to handle the entire oil side of the original company, The Amber Chemical Co Ltd.

Royal Dutch/Shell Changes

Dr H. Bloemgarten has retired from his position as managing director of the Royal Dutch/Shell Group of oil companies. He has been succeeded by L. E. J. Brouwer, general managing director of the Iranian Oil Exploration and Producing Company and of the Iranian Oil Refining Company.

Dr Bloemgarten joined BPM in 1920 and served abroad as a geologist. In 1926 he returned to The Hague as chief assistant to the Head of the Production Department, and in 1935 he went to the U.S.A. where he was appointed a vice-president of Shell Petroleum Corporation (now Shell Oil Company) in New York.

Dr Bloemgarten was appointed a managing director of BPM in 1948 and later that year was appointed a managing director of Royal Dutch, The Shell Petroleum Company, and The Anglo-Saxon Petroleum Company. In 1955 he became chairman of Shell Research Ltd.

Mr Brouwer entered BPM in 1931 and after working abroad with the Royal Dutch/Shell Group for many years, was appointed co-ordinator of the Geological and Production Departments of BPM's head office in The Hague. He became managing director of the two Iranian companies in 1954.

The French Institute of Petroleum

By **E. A. SMITH***

In an address on "Research and Petroleum" delivered in Paris in 1955, R. Navarre, Director General of the French Institute of Petroleum, pointed out that the U.S.A. is making the machine do the work formerly done by manual methods. France is very conscious of the need for mechanizing manual operations and of the fact that in the forefront of this development, must, of course, be the full utilization of petroleum. Evidence of the practical lines being followed in fulfilment of this is provided by the

The Institute's Social Centre

progress of *L'Institut Français du Pétrole*, to give it its correct name. The writer had the privilege of inspecting the whole of the organization in 1951 and the results were reported in the *IP Review*, March 1951. Five years have elapsed and it seemed appropriate, therefore, to attempt to bring up to date the picture of the IFP, following a recent visit to Paris.

The progress within these five years has been significant, so much so that today the organization at Rueil-Malmaison, outside Paris, where the main research centre of the Institute is located, can hold its own with some of the best equipped research centres in the world. Wisely, the Institute decided that it should make full use of the experience of other countries and with that object in mind, teams have been sent to the United States and other countries, to bring back up-to-date ideas which can be incorporated in the developments at Rueil-Malmaison.

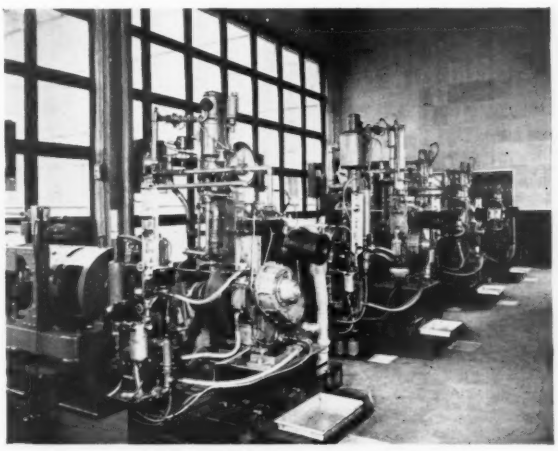
Walking through the group of buildings in their picturesque setting, about ten miles west of Paris, one is impressed with the modernity of everything. In some respects the engine test houses are, if anything, equivalent to the most advanced ideas on the subject in the U.S.A. It is evident that the French Government has faith in both the value of organized research and in its Director, Robert Navarre, and his highly competent staff.

Since the last visit the pilot plant for petroleum research has been completed. The most striking feature of the layout is, however, the new block housing engine testing. Some of the diesel engine work formerly carried out at the Claude Bonnier Laboratories, a few miles away at Bellevue, was moved to Malmaison and grouped with oil and petrol engine activities. More attention is being devoted at the Claude-Bonnier Laboratories to fundamental aspects, such as combustion, test bed work being emphasized at Rueil-Malmaison.

It is difficult to summarize intelligently in a short space, the material progress made by the IFP since 1951, so this report will be confined to references to the engine testing facilities and pilot refinery plant. The test shops are laid out on either side of a main corridor in which are housed the control panels. A full range of test bed operations can be thus carried out silently and cleanly. Of particular interest in this corridor is an electronic device which reproduces on the test bed the exact motoring conditions met on the road. Electronic recorders are taken out in a test vehicle, which operates in cities and in towns in a normal way. The recording is then taken back to the laboratories and linked with a corresponding engine on the test bench. All of the cycles, such as gear changing, deceleration during braking, and acceleration on open stretches of road, are reproduced in the test bed unit. This brings engine wear testing much nearer to road conditions of operation and represents an important step, both on the technical side and the economic side. It is no longer necessary to send out vehicles on the road, with investigating teams, for the purpose of road testing, this now being possible on the bench. It is recognized, of course, that air and temperature conditions are not, necessarily, reproduced faithfully by such a procedure, but this is taken into account in designing the laboratory tests.

Supporting the engine research and testing shops, is a

The test room for oil engine fuel and lubricant rating. Petter engines are used.



* Technical Manager, Acheson Colloids Ltd.

group of laboratories, chemical, physical, and metallurgical, situated on the floor above. Particularly impressive are the lighting and ventilation accorded by modern industrial architecture, which, of course, must inevitably lead to higher efficiency.

The departments of geology, production research, and oilfield research, have added to their equipment, while there has been an overall growth in the numerical strength of the IFP staff. It is interesting to note that information being derived in the laboratories of the IFP is not exclusively reserved to France. Thus, various papers are being delivered by members of the staff, a good example being the large-scale intervention of the department of applied thermodynamics and kinetic chemistry, at the XXVIIe Congress International de Chimie Industrielle, in Brussels, September 1954, when several papers on basic aspects were presented. A measure of the success of the IFP in the rôle of research in France is due to the dynamic personality of the Director General, Robert Navarre, to whom tribute was paid by more than one member of the staff. Of particular interest to industrial concerns in other countries, is the fact that the IFP is in a position to carry out engine testing and other research work on payment. This, naturally, has focused some attention on the lubricants and fuel testing facilities, which are as modern as anything in Europe.

Courteous help in the preparation of this report was given by everyone at the IFP, and in particular by three who are well-known in England, J. Groff, R. Courtel, and R. Vichnievsky.

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The New President Takes Over

(Above centre) *Lord Geddes being welcomed into the Presidential chair by the retiring president, Lt-Col S. J. M. Auld; and at the Council Dinner with* (left) *Lt-Col S. J. M. Auld and C. A. P. Southwell and* (right) *the General Secretary, G. H. Thornley, and W. S. Ault.*

(Left) *at the Council Dinner, M. E. Hubbard,* (left) *the new Member of Council, discusses procedure with the Honorary Secretary, C. Chilvers.*

Petroleum in Parliament

Middle East Oil Resources

The Secretary of State for Foreign Affairs was asked if in view of the fact that much of the danger in the Middle East arises from the endeavour of Powers to safeguard their supplies of oil, he would propose to the nations concerned that a study be made of the proposals put by the International Co-operative Alliance before the United Nations Association and elsewhere, that the oil resources in the Middle East area should be developed by an international consortium.

In a written reply on 4 April, the Minister of State for Foreign Affairs replied that most of the oil resources in the Middle East were already being developed by international consortia, and through the equal sharing of profits the oil-producing countries were effective partners in the enterprise. The alternative arrangements suggested by the hon. Member would be impracticable.

On 25 April, the Minister of State for Foreign Affairs replied "No, Sir" when asked whether the Secretary of State for Foreign Affairs would propose to the U.S.A., the U.S.S.R., France, Holland, and the Middle East countries concerned, that a Middle East oil authority be established on the model of the European Coal and Steel Authority, in order to guarantee legitimate access to the oil of the Middle East and its fair distribution.

Oil Burning Factories

In a written reply on 1 May, the Minister of Fuel and Power said that returns collected from the larger industrial undertakings, accounting for about 90 per cent of the total consumption by industry, show that 22 per cent of them in the Northern Region, 38 per cent in the Eastern Region, and 35 per cent in the South Western Region use oil for burning to a greater or lesser extent.

Exploration and Drilling

In reply to questions in the House on 2 May, the Minister of State for the Colonies said that a well was drilled in Jamaica in 1955 without discovering oil but, on the strength of earlier drilling results, the Jamaican Stanolind Oil Co had now embarked on a $2 million exploration programme for the next two years.

He also said that four exploratory wells had been drilled in Barbados by the Barbados Gulf Oil Co since 1953. No oil had been found, but one well contained natural gas in commercial quantities which would be used to supplement the island's domestic supply. A fifth well was to be drilled.

Merchant Fleet

The Minister of Transport and Civil Aviation was asked on 11 April what percentage proportion of our total Merchant Service was represented by ore-carrying ships, tankers, and liners, respectively, in 1939 and 1956. In an oral reply he said that, in September 1939, 57 per cent of the tonnage of the U.K. merchant fleet was liners and 18 per cent tankers. The corresponding percentages in January 1956 were 51 per cent and 28 per cent. There were no specially constructed ore-carrying vessels in the U.K. fleet in 1939 but there were ten such vessels on 1 January 1956, representing less than one half of 1 per cent of the total tonnage of the fleet.

Oil Bunkering, Gibraltar (Negotiations)

In a written reply on 18 April with regard to the position of the proposal to allocate oil bunkerage space from Government installations in Gibraltar for commercial purposes, the civil head to the Admiralty said that negotiations with the commercial interests concerned were continuing, and he hoped that they would be completed in the near future.

Petrol Distribution

On 17 April, the President of the Board of Trade was asked if he was aware of public concern at the restrictive practices being put into effect in petrol distribution; and if he would refer the matter to the Monopolies Commission.

Mr. Walker-Smith said in reply that his right hon. Friend was aware of public concern in this matter. He was considering further references to the Commission but was not in a position to make any further statement at the present time.

Oil Storage Installations

Mr Russell recently asked the Minister of Fuel and Power to give further details of how his estimate of £697,000 on operation and maintenance costs of oil storage installations in 1956-7 would be spent.

Mr Aubrey Jones explained that part of the expenditure was for the repair and renewal of facilities built by the Government to safeguard the distribution of oil in an emergency; the remainder covered routine maintenance and operational costs.

Liquid Gas

Mr D. Price recently asked the Minister of Fuel and Power what progress had been made by his Department in research into the methods of shipping liquid gas from overseas oilfields into the United Kingdom. Mr Price also asked for an assurance that this line of research would be persevered with in view of the great potential prizes which were available for large quantities of natural gas throughout the world which were simply going to waste.

Replying to these questions, Mr Aubrey Jones said that research in that field was being pressed forward by oil companies and others in America. The Gas Council was keeping in close touch with these developments and was also working on the matter itself. There were, however, formidable technical problems associated with the shipment of liquid gas, and although he was anxious that the matter should continue to be pursued he should not like to forecast how soon the problems would be satisfactorily solved.

The Economic Impact of Oil on the Arab Middle East

By **JOHN MURRAY, O.B.E.** (*Fellow*)

Part V Wealth and Development

Since Venezuela set the ball rolling, the system whereby a concessionaire oil company shares equally with the producer country the profits calculated on the operation within it, has been adopted in all the major oil areas of the Middle East. The first agreement of this nature was that made between Aramco and Saudi Arabia in December 1950; this was followed by new agreements in Iraq, and then in Kuwait, Bahrain, and Qatar.* Thus the exporting countries obtained a higher rate of payment which, coupled with the expansion in output described in Part II, has produced that tremendous increase in State revenues of which Table VII gives a summary picture.

These large sums are being used in varying proportions on economic development, the provision of social services, the support of weakly current budgets or—sometimes—luxury living. Opportunity and method of spending differ: though some productive investment might be found in Saudi Arabia and, to a less extent, the Gulf States, it is clear that there much of the money must go on improving primitive living conditions or building a cash reserve. In all these countries, too, the Ruler is constitutionally the recipient of all revenues, and in most cases he and his family retain personally a sizeable share; but his identity with the State also means that in practice much of the oil receipts is spent as the country's normal income. Iraq, by contrast, has both real and great development opportunities and a parliamentary government which can control budgetary expenditure.

Iraq—Real Development

Iraq has, in fact, the greatest potential of all the countries concerned, for her natural resources include not only oil but other mineral deposits and, above all, large tracts of fertile land and abundant water. Her greatest scope for development lies in the use of these, for Iraq is, and is likely to remain, a predominantly agricultural country. Nor is there a population pressure on the available land, for only a 'little over five million people[1] live in an area of more than 170,000 square miles. Such figures do not, of course, tell the whole story: to say that the population density in 1947 was under 30 persons per square mile is not very revealing, since considerable parts of the country are barren; more enlightening is the assessment that there may be only about 100 persons to the square mile of cultivable land,[2] one-fourteenth the density in the settled area of Egypt.

The most fertile part of Iraq is the alluvial Mesopotamian plain which has little rainfall but ample irrigation water from the Tigris and Euphrates. In the centre of this level expanse wheat and barley are grown in the winter and vegetables, millet, maize, and sesame in the summer; in the swampy and over-watered south grow rice and the dates which are the country's most important agricultural export. The mountainous north-east forms a different zone, having a rain-fed agriculture producing winter cereals or tobacco in the foothills and valleys: to the west and south-west lie arid deserts inhabited only by nomads. From this agriculture and the rearing of livestock are derived Iraq's main exports, apart from petroleum—grain (in particular barley), dates, live animals, hides, skins and intestines, and raw wool and cotton.[3]

In the past, agricultural progress in Iraq has been hampered by the inability of existing irrigation and control works to utilize and harness the fluctuating rivers. Yet much advance has been made between 1950 and the days under Turkish rule when Sir William Willcocks drew up an irrigation programme and the Hindiyah barrage was built on the Euphrates. Between the wars this was supplemented by another at Kut on the Tigris, and ancient canals were cleared, minor works built, and irrigation pumps put in. But these were not enough; production has been retarded, too, by the system of land tenure, a tendency towards shifting cultivation, the primitive techniques employed, and the ailment, unexpected in the Middle East, of a shortage of agricultural manpower. The health and consequently working power of the population have also in the past been reduced by endemic diseases; nor did the system of communications encourage the transport of goods to market, for the main traffic axis running north to south was served chiefly by rudimentary roads and a railway of two gauges which had to carry the bulk of the country's trade to and from the only port at Basrah. But the existence of a railway at all marked a step forward; a Government machine and a modern state had been created; and by 1950 the country's indigenous products were also being used for a small but growing industry, comprising textile production, the manufacture of construction materials, and agricultural processing.

*The complicated details of these agreements would occupy too much space in a study of this type; the general principle is uniform, but provisions vary from country to country in regard to such matters as currency, the supply of cheap crude for State refineries, the maintenance of students at foreign universities, the establishment of guaranteed production levels, and the right of the Government to take part of its half-share in kind. Readers may be referred to S. H. Longrigg, "Oil in the Middle East", pages 191-192 (Iraq), 209-210 (Saudi Arabia), 217 (Bahrain), 222 (Kuwait), and 231 (Qatar). The same author also describes (pp. 193-194 and 214-215) the arrangements by which the Iraq Government took over certain properties (*e.g.*, refineries) of the Khanaquin and Rafidain Oil Companies, the former continuing to operate on a new basis, and the earlier (and differing) agreements under which Aminoil and Pacific Western entered the Neutral Zone.

During the last war there were large British Army expenditures in Iraq (£64 million between 1941 and 1944); prices therefore rose and agriculture was stimulated; moreover, the country acquired useful sterling balances, which in July 1947 totalled £57·9 million.[4] The budget, too, was in a satisfactory state and receipts exceeded expenditure; in the years immediately succeeding the conflict, however, prosperity declined, and deficits totalled ID.15·5 million for the 1945-50 period[5] (ID.1=£1). But since then the budget has become increasingly healthy: 30 per cent of the rising oil revenues have been allotted to it since 1952 and receipts from Customs and Excise* have increased in consequence of the expansion of the economy. It was not until 1953, however, that the United Nations[6] could estimate that revenue and expenditure had risen in real terms above the pre-war level: today the 1955-56 budget-makers can reckon on an expenditure of ID.65·2 million, more than double that for 1951-52; foreign exchange holdings are rising though imports go up; there is virtually no public debt; and the country has been able to cancel the undrawn portion of an International Bank loan and repay what little it had used.

TABLE VII

PAYMENTS BY MAJOR PRODUCING COMPANIES TO THE EXPORTING STATES

(Equivalent in Million U.S. Dollars)

	1950	1951	1952	1953	1954	1955
Kuwait ...	11·65	28·65	165·36	191·87	217·47	280·00
Saudi Arabia ...	112·00	155·00	170·00	166·00	180·00	(approx.) ...
Iraq . .	13·96	39·92	92·64	132·31	155·45	223·37
Qatar. .	.99	3.31	7.04	11·18	20·73	36·75
Bahrain .	1·98	2·92	4·25	5·08	11·09	...

Sources: Kuwait, Iraq, and Qatar—authoritative. Bahrain—Bahrain Government Annual Reports. Saudi Arabia—*The Economist*, 2 July 1955; also tentative estimates.

NOTES:

1. Figures have been converted at £1=$2·8; most of the payments are, however, made in sterling, conversion to which is impracticable since the currency make-up of the Saudi Arabia figures is not clear.

2. For all countries except Saudi Arabia the figures represent *actual receipts*, for the calendar year in the case of Kuwait, Iraq, and Qatar, and in Bahrain for the Moslem year which ended in the autumn in 1950 to 1953. The Bahrain figure for 1954, however, is an especially large one since the accounts were then adjusted to cover the calendar year: thus this item applies to the longer period September 1953 to December 1954. This "actuals" basis is clearly the best in assessing the countries' financial resources. It should be noted that entitlement figures, which are the basis in some authorities, *e.g.*, United Nations publications, do not normally agree with those above since there are sometimes back or advance payments.

3. The following special points should be noted in regard to individual countries:

(*a*) *Saudi Arabia: Actual receipts* for 1954 are given by *The Economist*, 2 July 1955, at $260 million; this included a large back payment. This country also receives comparatively small payments from Pacific Western, operating in the Neutral Zone.

(*b*) *Kuwait:* This State also receives comparatively small payments from Aminoil on account of Neutral Zone operations.

(*c*) *Iraq:* Figures exclude the effects of the operations of the Khanaquin Oil Company, which now operates on behalf of the Government; its earlier payments did not materially affect the figures.

4. Egypt, which is not an exporter, is not included in the above Table; oil payments do not have a decisive effect on the country's revenues. That they are not entirely negligible, however, is shown by a statement in the *Report and Accounts* of Anglo-Egyptian Oilfields Limited for 1954 that in that year this Company paid £1·31 million in royalty to the Government and £0·42 million in taxation.

5. Payments in the non-producer countries—Syria, the Lebanon, and Jordan—though not unsubstantial are not a major budgetary item: see, however, the discussion of these countries in the text below.

Photo by Iraq Petroleum Co Ltd

The inlet regulator of the Habbaniyah scheme

Increased receipts are not the only reason for the budget's health, for major capital works have largely been taken out of the expenditure side since the creation of a Development Board in 1950. Most of Iraq's productive spending is now in the hands of this body, which has considerable powers of planning and execution and is allotted 70 per cent (originally 100 per cent) of the oil revenues. At first consisting of six (later seven) executive members, the Prime Minister, and the Finance Minister, the Board had its independence somewhat reduced by a law in 1953 which created a Ministry of Development and added that Minister to its members.[7] It first prepared a five-year programme—later supplemented to cover a sixth—which envisaged expenditure of ID.155 million against revenues of nearly ID.169 million over the period 1951-1956. It soon became clear that spending at this speed was impossible, for many of the projects were long-term and surveys had to be made; thus only ID.12 million was spent in 1953-1954 against a programme of ID.28 million.[8] Criticism of the absence of rapid development was not lessened by inadequate public relations machinery; indeed the Board seemed to believe that "merit will out"—not always the case in any country. Today there are both publicity and short-term projects, and Iraqis cannot help seeing new schools, hospitals, and bridges everywhere, for this part of the programme has advanced most closely to plan.

In February 1955 a further programme was presented to cover the five years 1955-59, involving against an estimated revenue of ID.253 million an expenditure of ID.303 million, allotted as shown in Table VIII. Of this Lord Salter, who shortly afterwards gave the Government a

*As in most Middle East countries these "easy-to-collect" indirect taxes form a large proportion of the whole.

TABLE VIII

IRAQ DEVELOPMENT BOARD 1955 EXPENDITURE PROGRAMME

Vote	*Particulars*	*Provision for the year 1955*	*Provision for the year 1956*	*Provision for the year 1957*	*Provision for the year 1958*	*Provision for the year 1959*	*Total*
	CHAPTER 1						
1	Administration expenses	650,000	650,000	650,000	650,000	650,000	3,250,000
2	Amortization of Tharthar loan	—	550,000	550,000	550,000	550,000	2,200,000
3	Irrigation, drainage and storage schemes	21,700,000	23,400,000	22,950,000	20,800,000	19,085,000	107,935,000
4	Roads and bridges	10,970,000	16,200,000	13,130,000	8,450,000	4,950,000	53,700,000
5	Airfields	500,000	1,500,000	1,000,000	1,000,000	1,000,000	5,000,000
6	Railways	5,500,000	2,500,000	2,500,000	2,500,000	2,500,000	15,500,000
7	Main buildings	4,300,000	7,450,000	7,690,000	5,600,000	3,510,000	28,550,000
8	Industrial, mining, and electricity	8,211,900	12,737,000	8,322,200	7,200,000	7,100,000	43,571,100
9	Development of animal, plant, and underground water resources	1,665,000	1,565,000	1,275,000	1,185,000	785,000	6,475,000
	Total of Chapter 1	53,496,900	66,522,000	58,067,200	47,935,000	40,130,000	266,181,100
	CHAPTER 2						
10	Buildings and institutes	6,250,000	6,250,000	6,250,000	6,250,000	6,250,000	31,250,000
11	Miscellaneous projects	1,525,000	1,275,000	1,025,000	1,025,000	1,025,000	5,875,000
	Total of Chapter 2	7,775,000	7,525,000	7,275,000	7,275,000	7,275,000	37,125,000
	Grand Total	61,271,900	74,077,000	65,342,200	55,210,000	47,405,000	303,306,100

Figures in Iraqi Dinars

Source: Lord Salter, "The Development of Iraq", p. 137.

report which is a real guide to economic development, comments, "This is deficit budgeting on a large scale"[9]; however, it was probably assumed that not all projects would cost as much as estimated and that the oil revenues would rise. More recently it has been announced that this plan has been extended by one year and the expenditure raised to ID.416 million; particularly important additions are the increase of provision for housing to ID.24 million and for industrial projects to ID.60 million. The new programme is divided into long-term projects to cost ID.364 million and short-term items allotted ID.52 million; more recently still a further revision has been announced with a cost estimate of ID.488·5 million.[10]

The largest element in these programmes, both in size and eventual importance, is the allocation for irrigation and flood control. Iraq's problem in regard to water is simple to state but complicated to solve: the plain has too little in the autumn, too much in the late spring when the Twin Rivers rise in damaging fashion as the snows melt on the Turkish and Persian mountains.* Huge schemes now under way are therefore designed both to prevent the negative element of flood damage and to ensure that water which previously ran to waste at the peak period is conserved and dispensed for irrigation during the low; the two main elements of the flood control were recently opened, and within a week had proved their worth. On the Euphrates a barrage and regulator can turn surplus water into the Habbaniyah Lake, from which it can be fed back to the river as required for irrigation or, if there is too much of it, be run into depressions to the south. Even larger is the scheme in which a barrage and regulator at Samarra can divert the Tigris floods into the Wadi Tharthar through a channel so big that 50 million tons of spoil were removed in digging it.

Though the Tharthar depression may prove to be a gigantic irrigation store, the most active plan for conserving water is that involving a group of dams on the tributaries of the Tigris, which will also assist flood control and may generate power. Two of these are in hand: the Dokan Dam, 1000 feet wide and 300 feet high, is now being built on a gorge on the Lesser Zab to store almost 7 billion cubic metres of water; on the Diyala will be situated the Derbend-i-Khan Dam, costing ID.23 million and 400 feet high but with a smaller storage capacity.[11] Other dams are planned in this group—on the Tigris at Eski Mosul, on the Greater Zab at Bekhme, to name only two—but it is not clear that all these will be proceeded with: they represent over-insurance in Lord Salter's view at least.

But though flood control is largely assured and storage on the way, the water must also be spread by irrigation and drainage provided, vital in a country where salination is a grave danger. The Development Board therefore has extensive plans, evolved by many hands over many years, for utilizing the water from the two dams, for the re-construction of ancient canals, for works in the Gharraf area, at Hillah, on the Musayib project, and elsewhere.[12] It has been estimated that the programme as a whole might irrigate about 4 million acres of new land; of this the 1955 development plan aimed at bringing in about 700,000 over the next five years.[13]

The effect of all this, according to one assessment, should

*Contrasting these rivers with the Nile (which he describes as "the most gentlemanly" of the rivers of the world) Sir William Willcocks (quoted by Lord Salter, "The Development of Iraq", p.40) wrote: "The Tigris and Euphrates rise without warning; are always abrupt; carry five times the sediment of the Nile; have their annual flood in March, April, and May, too late for the winter and too early for the summer crops . . . In spite of the many drawbacks, the ancient Babylonians made of the Euphrates delta a country so rich that Alexander the Great conceived the project of making Babylon the capital of the world".

be that on the present standard of consumption Iraq might support 6·25 million inhabitants by 1960 and 7·6 million by 1966.[14] In fact, the population is not likely to rise so fast; but instead living standards should improve, partly owing to increased output per acre resulting from the new agricultural techniques being taught, the improvement of crops, the development of animal husbandry, and the processing and marketing facilities (*e.g.* for dates and tobacco) which the Government is now arranging. One difficulty has been outlined by Lord Salter: much of the new water is to be concentrated on fresh State land, which avoids the difficult problems of land tenure and the danger that development may create wealth for only one section of the community, but also means that production from privately-owned land may not rise as it could.[15]

Though economically Iraq is primarily an agricultural country, this does not mean that there should be no industrial development at all; but, as Lord Salter points out, industries aided by the Government must be selected "as being based upon domestic resources and being assured of a domestic market".[16] On the whole, these criteria are met by the projects which the Development Board had planned or initiated even before a recent industrial survey by the firm of A. D Little. Of these, the largest is the construction of a cotton spinning and weaving plant at Mosul, which may soon be operating; in conjunction with existing factories this should enable Iraq to meet its own textile requirements: also intended to meet local needs is the construction of two cement plants in the north, designed to be close to the sites of the major dams. Another active project is that for a beet sugar plant at Mosul which will refine sugar from imported cane in the off season, and eventually meet about one-third of Iraq's annual demands. Other industries which might be encouraged are vegetable oil extraction, tanning, brewing, flour-milling, furniture-making, and the like. In these developments power will be essential; on this subject the Board has had an important report from the consultants J. G. White and Co, in accordance with which work is going ahead on schemes combining many small local generators with the construction of large power stations for the three regions round Kirkuk, Baghdad, and Basrah.*

Outward signs of Iraq's progress in transport are the red double-decker buses in Baghdad, organized on LPTB lines and aided by Development Board loans. These are not, however, the major communications scheme in hand: the railway is to be developed and modernized; a new port is contemplated at Umm Qasr to supplement Basrah; and everywhere existing roads are being improved and new ones built to permit access to the dam-sites, to open up agricultural land, or link Baghdad by all-weather highways to Basrah and Mosul. The total cost of the road and bridge programme, even in the 1955 estimate, was ID.54 million; visible signs of its progress are a road from Hillah via a bridge at Kufa to Najaf, which has just been opened, and two new bridges in Baghdad which will shortly aid the congested internal circulation of the city.[17]

*The steps taken by the Iraq Government to provide for the country's internal consumption of petroleum fuels by the construction of a refinery, lubricating oil plant, and bitumen plant, have been already noted in Parts II and IV. The large scheme for a plant at Kirkuk utilizing natural gas to produce fertilizer, etc. is still under consideration. This was first put forward by the International Bank Mission which visited the country in 1951, in their Report, "The Economic Development of Iraq", 1952, p. 37, pp. 287-290.

Photo by Iraq Petroleum Co Ltd

The rugged site of the Dokan Dam

A considerable amount of money is also being devoted to social services: housing schemes are in progress, and towns are being re-planned and public buildings erected on a large scale: in Baghdad these include a new Palace and a Parliament House. Since December 1952 education in Iraq has been free; a programme of expansion is in progress under which the Development Board recently claimed[18] that 75 primary and 12 secondary and intermediate schools had already been built. Technical schools—a necessary development—are to be constructed at Baghdad, Kirkuk, and Mosul; and the enlarged budget is permitting an increasing current expenditure in this vital field. The health programme is another element which cannot fail to have a profound social impact on the country; clinics, hospitals, houses for medical staff have all been constructed, and in Baghdad a Medical Centre, costing ID.3 million, will combine a 950-bed hospital with the medical, dental, and veterinary colleges.

These programmes may not always be balanced and can be criticized in some of their details; but their overall effect is great and valuable. Internal reforms and the tackling of the gritty problem of land tenure may be necessary before development has its full beneficial results; but it is certain that Iraq, of all the Arab lands possessing oil wealth, is using it best in the formation of assets which will increase prosperity by themselves in the future. If oil were to vanish from the earth in a hundred years' time, this is a country that on present form would still go on.

The Magic Circle

Welfare in Kuwait

Of the magic circle of States which ring the western shores of the Persian Gulf, Kuwait is the most remarkable, not only because of its oil output but since it seems astounding that it should exist at all. The city stands in a wedge of 6500 square miles of sand and gravel with no apparent resources save one or two fertile patches on the coast and a few brackish springs. Yet it has long been sizeable, and its people may have numbered upwards of 150,000 even before oil development brought the population to its present level of some 200,000.

How did such a city subsist since its first settlers arrived about two centuries ago? The answer lies partly in its position on a bay at the head of the Gulf where it served

There are still pearl-merchants in the Kuwait bazaar and boat-building on the shore; but these are no longer a main support to the economy

as a natural port of entry for Najd, and partly in the enterprise and toughness of the Kuwaitis themselves. A hundred years ago Palgrave wrote, "Among all of the seamen who ply the Persian Gulf, the mariners of Koweyt hold the first rank in daring, in skill, and in solid trustworthiness of character . . . import duties are low, the climate is healthy, the inhabitants friendly, and these circumstances, joined to a tolerable roadstead and a better anchorage than most in the neighbourhood, draw to Koweyt hundreds of small craft".[19] Thus trading, boat-building, fishing, pearling, and Sindbad-like voyages[20] provided the funds with which the State could import much of its food, the drinking water for its men, and the fodder for its animals. Sometimes these resources failed; the pearl industry languished and between the wars a Saudi blockade caused a drop in trade which was only partially offset by some profitable smuggling to Iraq.[21]

The benevolent character of the Ruler, not less than the paucity of natural resources, meant that when large revenues began to pour in he determined to spend them principally on improving the living conditions of his people, which must always have been precarious and never very comfortable. To produce a welfare state rapid spending was instigated, planned on a scale appropriate to a country with perhaps the highest *per capita* income in the world.[22] A serious difficulty, which still to some extent persists, was the lack of a proper administrative or budgetary system when development began;[23] this has been reduced, though not wholly eliminated, by the employment of many foreign advisers and technicians—British, Syrian, Lebanese, Palestinian, Egyptian—to provide the administrative and professional skills which most Kuwaitis have yet to learn. There has also been a slowing down in the general pace of development; in the first excitement Ruler and citizens alike demanded both speed and the highest quality, elements which are apt to prove expensive and disrupting to orderly planning when conjoined. Both were certainly provided, however, by the adoption of a scheme whereby most of the construction was given to a group of five large British contractors in partnership with Kuwaiti merchants; but this system inevitably caused jealousies and was eventually abandoned.

Nevertheless, though not all the projects in a five-year £91·5 million programme[24] planned in 1952 have been carried out, and such ideas as the expenditure of £3 million on a luxury hotel have been at least temporarily shelved, Kuwait has already been transformed. Roughly one-third of the revenues today goes to the Ruler's family and the running of the State, one-third to development spending, and one-third to an investment fund lest lean times strike the oil industry. Much construction still goes on, with the emphasis on public utilities and social services: first in importance, perhaps, is the power station and sea-water distillation plant which not only provides, as it were, the lifeblood and nervous energy for normal living but is an architectural ornament to any city. Both may be enlarged, the expansion of the latter being economically feasible since (in combination with the thermal station) it is fuelled by free gas from the fields. The extent to which further distillation will be needed depends on the fate of a scheme for a pipeline from the Shatt-al-Arab to carry 75 or 100 million gallons of fresh water per day. Recently dropped but now reported revived, this plan may not make agriculturists of the Kuwaitis (who have no tradition as cultivators), but might at least make horticulture possible. In the uniform dull brown and yellow city, with few trees and

little grass as yet, ample irrigation would at least provide a gigantic amenity which this oil-rich State could well afford.

Social services run utilities close as a contribution to the life of the State; in particular the Ruler has concentrated on education from the outset and the primary schools, extremely well equipped, extensively-staffed (mainly from other Arab countries) and planned on a large-scale programme, are outstanding examples of modern architecture and an ornament, both as buildings and the representation of an ideal, to any city. The effect of this educational development on the social and political life of Kuwait is likely to be immeasurable, though as yet an insufficient supply of pupils is emerging from the primary stage to fill, for example, the large technical school or the quite splendid secondary building which may grow into a university. But the whole concept is a very fine one; the group of nursery schools, the communal feeding of 20,000 children, the best South Bank architecture—these are new things to the Middle East. All this education is free, as is the skilful medical treatment now supplied by a group of State doctors. Generally in the Middle East the number of medical practitioners is seriously insufficient to the needs of the population; this is not so in Kuwait, which is also now well supplied with clinics and hospitals.

Kuwait has had first-class town planning advice, and the city has been zoned into nine residential areas with an industrial sector on the outskirts at Shuwaikh. It is doubtful if the Arab likes to be planned, and spontaneous industrial development seems more active in the town itself than in the allocated areas, where there are one or two monuments to mistaken expenditure. Not among these is a sand-lime brick factory some miles out of town, for which there is plenty of raw material and a good demand as houses rise, new boulevards are cut, and new Government buildings erected. And all these things are still going rapidly forward, for the emphasis today seems to be mainly on the construction of roads[25] and housing estates, a programme which is spreading money among traders, contractors, labour, and those who are paid compensation when their mud walls crumble under the impact of the new Kuwait.*

Economically it would be satisfying were the re-construction of the port also proceeding rapidly, for this is a bottle-neck. Nor has the programme established many self-supporting elements of the economy—in fairness, it is difficult to see how it could—while the welfare state will involve increasingly heavy maintenance charges. These should be taken care of by the growing investment, however; the general concept is in any case a fine one, and the country can afford to carry it. But steady improvement in administration and more orderly over-all planning are yet needed by a State which, though the first spending rush has passed, is still today highly prosperous.

Bahrain—Oil and Budgets

Further down the Persian Gulf two even smaller states —Bahrain and Qatar—are receiving oil revenues not on the Kuwaiti scale but nevertheless substantial. Of these the former is by far the more advanced and better adminis-

*"Let them be demolished! Who wants them now? It is the new Kuwait and not the old which is worthy of admiration." (Kuwaiti girl quoted by Zahra Freeth, "Kuwait was my Home", p. 83).

Young Kuwaitis are being educated in State secondary and primary schools

tered but also financially less fortunate and politically more vocal. Bahrain has always been of more importance on the Gulf than its size would indicate; central in position and with over 110,000 inhabitants packed into its 200 square miles,[26] this little group of islands is a port of call[27] and an *entrepôt* through which trade passes to the Arabian peninsula; thus even in 1954, which was not a good year, perhaps 50 per cent of its imports were re-exported. As a commercial centre, however, Bahrain is today suffering somewhat from the competition of new inlets on the mainland; more marked has been the decline in the pearling industry, once the most important in the Middle East and the main source of genuine wealth to the islands.* This is now a minor element in the economy compared even to the somewhat surprising agriculture maintained by fresh water which, by a freak of nature, springs up even in the sea from distant gathering grounds. Thus the economy of the State was not without props when the oil industry was founded; but these might have proved insufficient to maintain a reasonable prosperity for long, and the new revenues and local expenditure have provided an invaluable additional support.

Bahrain's finances have been strengthened though not swamped by the oil revenues which, though assisted by duty on the crude piped from Aramco's fields to the major refinery, are not large since the limited local production has recently remained static. Yet receipts have risen steadily; in 1927 State revenue was much less than £100,000, of which 85 per cent was derived from Customs[28]; for the period (rather more than a year) ending 31 December 1954 it was £5 million, of which nearly £4 million or close on 80 per cent came from oil. The State is unique in the Arabian Peninsula in that a properly organized budget has appeared for many years as the visible index of orderly—indeed cautious—spending by progressive Rulers, advised over a long period by Sir Charles Belgrave. One third of the oil revenue is paid to the Privy Purse; but the Ruler contributes part of this to education, public health, and other Government services: of the remainder, an amount, estimated in 1955 at one-quarter of the residual expenditure, is regularly put to a reserve fund to provide an income "when the oil revenue begins to diminish". Since reserves are not large this is sound, though an investment totalling no more than £7 million would not by itself provide a sufficient income.[29] The remaining expenditure is applied either to the recurrent costs of the State—of which education and public health are generally the largest items—or to capital development.

Bahrain's progress has been not spectacular but steady or, in the words of a Lebanese newspaper, "sans hâte excessive"[30]* Administration is good and progress has always been patterned on the improvement of public utilities and social services. Water supplies, a gas-electric scheme, hospitals and dispensaries, the elimination of malaria, the improvement of the port, and the construction of schools—these have been the main items of expenditure in recent years. The people of the islands were never markedly unlettered nor without foreign contacts, for the seamen travelled and commerce opened a window for the merchants to the outside world; education has broadened this basis of knowledge and the primary schools are full. As in Kuwait, however, the technical school has surplus capacity, for there is some "disinclination for technical training",[31] which may indicate a feeling that it is derogatory to learn a trade. Yet this and the technical development of agriculture are desirable if the steady progress of the island's economy is to be broadly based and to keep pace with the social change and political developments which are now being demanded.

*In 1930, 500 boats with crews of 20,000 were working the warm shark-infested waters above the pearl banks; the value of the catch was 2 million rupees in days when that coin was a tip of size. By 1948 only one-tenth as many men were working 80 boats with a catch value of less than 1 million of rupees having a much lower purchasing power. This falling-off in the industry was not steady but fluctuated with the appearance and temporary war-time disappearance of the Japanese cultured pearl (see Belgrave, J., "Welcome to Bahrain", pp. 46-52).

*"Bahrain has had the most extended and most orderly development toward modernization of all the principalities" (H. J. Liebesny, "Administration and Legal Development in Arabia—the Persian Gulf Principalities", *Middle East Journal*, Vol. 10, No. 1, Winter 1956, pp. 33-42).

The traditional shipping of the Persian Gulf

Photo by Bahrain Petroleum Co Ltd

The Barren Peninsula

The 25,000 inhabitants of the desert peninsula of Qatar did not, before the advent of oil, enjoy the commercial advantages of Kuwait or Bahrain; indeed Doha, the capital, gradually lost what little trade it had, and most of its people barely kept body and soul together in the subsistence life of fishing and pearl-diving. There is little water in the 8000 square miles of hinterland where a few nomads lived precariously by herding. Oil, however, is now irrigating this unpromising soil, not so much literally (though there is now a fresh water supply in Doha) as in providing virtually the whole of State revenues which can make life more tolerable. After the Ruler and his family have received their share of these (perhaps one-third), the rest is divided in fairly equal proportions between current expenditure, development, and the building up of a reserve.[32]

It is not simple to find opportunities for productive investment in such a territory; but the new wealth is already doing something to produce a small-scale welfare state, aided in this by the direct activities of the oil industry. British advisers are employed, and some Government departments have been established; there is now a power station, a primary school, and a hospital; a legal system and a police force have been built up, and accommodation is now available to attract the foreign technicians needed by this lately illiterate and backward country. So Doha is growing into something of a modern town; one ambition of the State is to develop the port to supplement or replace for civil purposes the facilities which the Qatar Petroleum Company makes available at Umm Said. Financially, the future of Qatar seems well covered; but it is idle to suppose that it can ever become a little Iraq.

Saudi Arabia

The vast deserts of Saudi Arabia are even more barren in exact statistics than they were in sources of revenue before oil was found; thus the area of this huge country, hammered into a whole by the military prowess of Ibn Saud, can be only vaguely estimated at about 800,000 square miles and its population at 3·5 to 4·5 million.[33] Traditionally this is the home of the Bedouin nomad; and indeed most of the inhabitants are tribesmen who move from place to place as their animals feed on the scanty and impermanent vegetation. But in fact there are considerable settled communities and Mecca, Medina, Qatif, Riyadh (the capital) and the Red Sea port of Jeddah were sizeable towns even before oil development drew population to the north-east; estimates of their size, however, vary so greatly that figures ranging from 30,000 to 120,000 are quoted even for Jeddah.[34] These towns are built near oases; otherwise the country is largely sterile, save for Asir, the Red Sea coastal highland of the south, which has rainfall and even grasslands.

There is thus some subsistence agriculture in the country; indeed it has in the main produced its own food from the date, cereal, and coffee crops of the irrigated areas and the livestock products which the Bedouin bring to the bazaars of the towns to exchange for such imported commodities as rice, sugar, and cotton cloth. But there were few industries or even crafts in the past, and almost the only mineral exploited—and that in recent years—was gold, extracted at first from the tailings of an ancient mine by the application of modern techniques.[35] Thus in early days the resources to pay for needed imports had to be obtained by loot or tribute derived from military conquest, or more recently by the foreign exchange brought in by the pilgrimage to Mecca. By the 1930's this was the principal revenue source; and when in the recent war this fell off, the country had to be sustained by British and American help.

Saudi Arabia did not publish a budget until 1947, and the irregular trickle of figures since then does not give a very clear picture of how the Government is spending receipts which in 1954-55 were estimated to be 85 per cent from oil and 8 per cent from the customs and harbour dues. Revenues were large at Saudi rials 1143 million (about £110 million); yet expenditure was estimated to exceed them at a figure of nearly £140 million.[36] Nor was this overspending isolated; wealthy as the Government should be, it has built up no reserve and is thought to be overdrawn against expectations, though not in the form of advances from Aramco.

This improvidence is partly due to the primitive administration, adequate for Ibn Saud's strong feudal control and nomad settlement programme, but not for an oil-rich modern State, and partly to what Philby calls "the wave of extravagance which swept over the country on the rising tide of royalties from oil",[37] in which the enormous Royal family and their henchmen and tribal chiefs have mainly participated. Many stories are current about stupendous tips, palaces built on sand, fabulous Cadillacs and extravagant princelings by the score; the political influence exercised elsewhere in the Middle East probably does not come cheap, and subsidies to keep the tribes quiet and defence, though they may have spread the wealth, seem over-valued at nearly 40 per cent of the 1954-55 budget. Yet some administration is developing, an important advance having been the establishment of a Monetary Agency in 1952; such changes possibly account for the disappearance from the estimates of a large item for "Riyadh affairs" and the introduction of a specific allocation for the Palace. But to estimate expenditure on such things from the published figures is an idle occupation; more clear-cut is the fact that social services now account for 8 per cent of the budget and development work 16 per cent, part of these items being for public health and education—which do move forward—with a very small element (2 per cent) for agriculture.[38]

Some progress has of course been made. The most effective development schemes have probably been those on which the oil company has supervised the expenditure of Government money; thus a remarkable effort has been made to produce model farms at the deep water pits of Al Kharj, on which a great deal of hard work has been put in by American technicians. Good crops (which seem, however, to flow mainly in the direction of the Palace) have been produced despite difficulties with sand, locusts, salination, and even floods.[39] A new port has been built at Dammam on the Persian Gulf, which has been made the terminus of a railroad (cherished dream of Ibn Saud) which now runs 350 miles to the capital and is said to be economically more successful than might have been expected: its freight, at first largely Aramco's, is now much more on behalf of the mushrooming contractors, merchants, and minor industrialists who have congregated in the oil area.[40] Some roads have been built, and postal services, telephones, hospitals, and schools have made their appearance. There is a plan to reconstruct the derelict Hejaz railway, presumably for the pilgrim traffic, and to extend the existing line from Riyadh to Medina and Jeddah; a six year road-building programme is also under consideration.

With all this, it is clear that much more might be done. Though it is probable that agricultural production has risen more quickly than population, this development clearly lags; Saudi Arabia will never blossom like the rose but it could at least husband its scanty water resources, develop Asir, and improve agricultural and livestock techniques. Yet both American Point IV assistance and the British locust team have been pushed out of the country in a self-blinded nationalism. Moreover, schools and medical services, though their progress appears good when compared with the days when there was almost nothing, are actually totally inadequate to the country's needs. Saudi Arabia has some, but very limited, natural resources other than oil: as far as possible, these should be developed and a large reserve built up to ensure permanent prosperity. The lack of the latter at least is not immediately felt; in the words of *The Economist*, "money poured down the drain at least needs no up-keep".[41]

The Non-Exporters

This picture of the effect of oil on the Arab Middle East would be unbalanced were it not rounded off by a brief consideration of those countries which are non-producers, or at least do not produce for export. Of these, the barren Shaikhdoms of the Trucial States are still very poor despite some foreign help and such aid to their finances as is provided by exploration activity. Pearling, herding, fishing, and seafaring have been their inadequate supports in the past; and the present scanty economic information indicates that even if oil is struck in the future, they can do little more than develop along the lines of Qatar. The countries which form the "bottom edge" of the Arabian Peninsula, however, have even now rather more to carry on with, for there is some rainfall; thus the Sultanate of Muscat and Oman, where exploration is proceeding, has a measure of agriculture and some potential for development. The British colony of Aden and its Protectorates also have a reasonable measure of economic support, the latter from agriculture, fishing, and pasturage, the former since it is a major bunkering port and exports so much salt that it is said that in 1950 this met 75 per cent of India's imports of that commodity;[42] moreover, it has a substantial *entrepôt* trade. There is no oil production in this area, but it has benefited from the establishment at Little Aden of the BP refinery which is now the main industry of the city.

Oil has not been discovered in the retrograde and autocratically-ruled State of the Yemen, which still places few conveniences in the way of the entry of foreigners and presents an economy probably even more primitive than it used to have in the past. Yet the discovery of oil here could produce real economic development, for the country possesses the only substantial rainfall in the Arabian Peninsula, and possibly other mineral resources; whether it would actually do so is a moot point, for in this State, above all, the ruling family would consider themselves the only justifiable beneficiaries.

The remaining countries to be considered—Syria, the Lebanon, Jordan and Egypt—fall into a different category: they have all, even Jordan, been exposed to the western influences of the Levant; all possess the apparatus of modern government, though not always a normal parliamentary democracy; all, except Jordan, possess considerable natural resources—though in Egypt these are likely to be insufficient for the needs of the people; and all are bound up in the oil industry, the first three by the complex of pipelines and terminals, Egypt because she is a producer though in sum an importer.

Potential without Production

Of these countries Syria receives, since the recent transit agreement with I.P.C., the largest direct revenue from oil, estimated to be £6·5 million in 1956.[43] She has also the largest potential considered in proportion to her population of something over three million, for less than three-quarters of the cultivable area is actually being cropped and there are irrigation possibilities.[44] Nor is her industry negligible; and it has recently expanded.

Though internal political difficulties and an excessively sensitive nationalism may have hindered economic development, Syria has since the war nearly doubled the area under irrigation[45] and expanded the cultivation of cotton, introduced sugar beet, and increased cereal exports; the reclamation of swampy land in the Ghab valley and development of the rain-fed Jezireh should further increase output. The latter region is indeed the country's greatest asset; an ancient granary, the area is suitable for mechanized farming and its production was greatly raised by M.E.S.C. during the war and more recently by the activities of large land-holders.[46] One of the plans of the Syrian Government is to construct access roads to the Jezireh; it is time that this was done, development controlled, and an answer found to land tenure complications, so that the ordinary cultivator may benefit and the danger of turning the region into a dust bowl be averted. At the same time, a new outlet is being provided by the reconstruction of the port of Latakia, from which a railway may later lead inland. These developments have been mainly financed from internal resources;[47] if these can be further utilized, together with the oil revenues, on lines indicated in a recent report by an International Bank Mission,[48] Syria should make considerable economic progress, despite the (fairly wide) limits of her natural resources and an apparent aversion to foreign capital investment.

Prosperity and Invisibles

Superficially the Lebanon appears to possess less extensive resources, and its economists like to remark that its continued prosperity is something of an economic miracle: a great excess of imports over exports is balanced by the foreign exchange brought by the tourists who frequent its mountains and cabarets, the sick who come to be cured and the youth who come to be taught, by the commercial profits of shrewd merchants in the *entrepôt* and money market of Beirut, and by the remittances of her enterprising sons who make fortunes in North or South America. Added to this, the country is blessed with well-watered valleys and a fertile if small coastal plain, on which flourishes the intensive culture of fruit and vegetables. The Lebanon is therefore well situated to make from oil not only a direct income—since there are in the country two terminals, two refineries, and many oil company services—but to intercept the overflow of wealth from the producer states through spending on Lebanese amenities, investment in real estate in Beirut, and the increased tourism, educational, and health expenditure of the now more prosperous citizens of less comfortable countries. Fresh fruit and

vegetables, too, are exported to the oil companies and their personnel come for leave, medical treatment, or training.[49]

Commercially and professionally prosperous though she is, the Lebanon has no large source of capital for productive investment and no huge potential for development. Last year, however, the Government set up a Ministry of General Planning,[50] responsible for economic projects; among these, the use of water resources to produce hydro-electric power ranks high, the largest element being the plan for the utilization of the Litani River.[51] Roads are being improved, minor irrigation and power schemes are planned, and secondary industry may well expand under the stimulus of the most sophisticated market in the Middle East. Thus, though natural resources are limited, there are development opportunities; above all, the country has human capital in the skills and enterprise of its shrewd citizens. Consequently, even if the Lebanon never strikes oil, it will probably continue to strike it rich.

The Over-Crowded Room

Unlike these countries, Jordan, politically disturbed today, is in a melancholy economic position—and these things are partly effect and cause. At one time its limited agriculture and pasturage could sustain the original population of half a million; but when nearly the same number of refugees and over 400,000 West Bank Palestinians were added to the country without a compensating amount of productive territory, the result was economically disastrous.[52] The population rose 150 per cent, the cultivable area only 35 per cent; the wealthier pressed on housing, the poorer on wages; and the position was complicated by the fact that many villages were separated by the frontier from the lands which gave them subsistence. Moreover, the economic boycott of Israel has injured Jordan by making goods once imported through Haifa much more expensive owing to the long haul from Beirut.[53]

The discovery of substantial oil reserves would bring more relief to Jordan than it would to almost any other Middle East country; unfortunately, this seems unlikely. Her balance of payments (which has been described as "an economic curiosity of some note in its own right")[54] would be hopelessly in deficit were it not for the expenditure of the United Nations Refugee Agency (UNRWA) and the American Technical Assistance Office, and, above all, the subsidies paid by Britain for the support of the Arab Legion, the balancing of the budget and as development loans—the latter the main source of such development as the country has been able to make. Effort has been concentrated on items which will aid the balance of payments by reducing imports (*e.g.* a cement plant and a proposed refinery) and on the development of phosphates, the principal mineral resource of the country, together with the expansion of the port of Aqaba to permit their export. Indeed, this is now Jordan's largest export item and no insignificant support to the economy . But it does not seem that the future can hold much prosperity without some major change; nor can this come merely by the pouring-in of capital: as one writer realistically remarks, "What is the money going to be spent on?"[55]

Oil, but not enough

The ailments of another country are less acute but may well be chronic: unless there are sudden (and somewhat unexpected) developments on a major scale, revenues from indigenous oil production are not likely to play a large part in financing Egypt's development plans. This is the more unfortunate in that the Egyptian population, large in comparison to the area which can be put under cultivation (strictly limited by the amount of water now available), is continuously growing.[56] It is not easy to farm the present cultivated area more intensively; the system of canals, pumps, and dams is highly complicated and effective, and there are few harder workers on the land than the Egyptian peasant, who manages now to get three or four crops every two years out of the fertile soil. Egypt's plans are, therefore, based on an expansion of industry (which among other things may require hydro-electric power) and the acquisition of more water. Above all, the hopes of her present Government are placed in the project for a great dam at Aswan, which may cost as much as £470 million, partly financed by a loan from the International Bank, partly from national sources, and partly by aid from Britain and the United States. Difficulties with the Sudan, which also wishes water and will lose a town and territory when the dam is built, must be ironed out and detailed comparisons made with previous schemes putting the eggs less into one basket, before this plan proceeds: meanwhile, the sweetest dreams of Egyptian officials are probably that they have wakened up to find that the Ghawar field has been located under their windows during the night.

Oil and the Balance of Payments

It will be seen that the effects of the direct payments made by oil companies to the countries of the Arab Middle East are important and varied: Iraq, with the greatest potential, is wisely investing much of its revenues to create enduring wealth; some States, in particular Kuwait, are bent on improving social conditions in the absence of resources to develop; some of the money is wasted; and some countries have not enough for their needs. Indirectly the oil wealth, though limited to certain States, is producing a stepping-up of economic activity throughout most though not all of the region; and this is supplemented by the direct spending of oil companies discussed in Part III, and the greater availability of fuels which is the subject of Part IV. One further economic effect of the oil industry may be mentioned in conclusion: both company expenditures and State revenues are normally in foreign exchange, which is an important item in financing imports.

In the absence of adequate trade figures, let alone balance of payments calculations, for such countries as Saudi Arabia and Kuwait, it is impossible to say exactly what part is played by these exchange receipts; but clearly both States are able to finance any imports they may wish. More illuminating are the figures for Iraq, where in 1953 a debit balance of ID.33 million in the balance of payments trade and services items was more than off-set by a credit of nearly ID.54 million resulting from the transactions of petroleum companies.[57] The figures for Jordan, on the other hand, showed a heavy deficit on the current account of the balance of payments, for goods and services brought in a credit of only JD.6 million against a debit of over JD.20 million. Such a contrast points to one more advantage of the oil-exporting States: they can say, as British Chancellors cannot, "We have no balance of payments problem".

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[1] 1947 Census of Iraq (4·8 million persons).

[2] "The Middle East—A Political and Economic Survey", Second Edition, p. 256. Royal Institute of International Affairs, London, 1954.

[3] For details of production, areas under crops, type of land-holding, etc., see the information given by Lord Salter, "The Development of Iraq", pp. 190-193, from the results of the Agricultural and Livestock Census, the taking of which in 1953 was a remarkable achievement on the part of the Government's Principal Bureau of Statistics.

[4] "Economic Development in the Middle East, 1945-1954", p. 92. United Nations.

[5] *Ibid.*, p. 106.

[6] *Ibid.*, p. 108.

[7] Further detail on the composition of the Development Board may be found in Iraq Government publications and a Review by S. J. Habermann, "The Iraq Development Board: Administration and Programme", *Middle East Journal*, Vol. 9, No. 2, Spring 1955, pp. 179-186.

[8] Figures from Lord Salter, *op. cit.*, p. 127.

[9] *Ibid.*, p. 130.

[10] Press and other reports.

[11] Development Board documents: Lord Salter, *op. cit.*, *passim*.

[12] Lord Salter, *op. cit.*, *passim*; also United Nations, *op. cit.*, pp. 115-116.

[13] Lord Salter, *op. cit.*, pp. 181 *et seq.*

[14] Calculation by the Economic Division of the United Nations Relief and Works Agency for Arab Refugees, made in 1954.

[15] Lord Salter, *op. cit.*, pp. 54-55, 204-205.

[16] *Ibid.*, p. 19: project details may be found in the same source, United Nations publications, and Development Board documents.

[17] Details of communications projects are contained in Lord Salter, *op. cit.*

[18] In a publicity document.

[19] Palgrave, W. G., "Narrative of a Year's Journey through Central and Eastern Arabia", 1865, quoted in Wilson, A. T., "The Persian Gulf", p. 251. Sir Arnold Wilson writing in 1928, paid himself the following tribute (*ibid.*, p. 253): "The people of the town are very generally considered superior, alike in business ability and in those elusive qualities that go to make the good and dependable citizen, to those of any other Arab port; in no part of the Persian Gulf have the relations alike of the Shaikh and his people with the British Government, its Representatives, and with British merchants been more uniformly pleasant and cordial."

[20] See Zahra Freeth, "Kuwait was my Home", 1956, pp. 99-109, for a description of pearl-divers, sailors, and fishermen.

[21] An estimate of the tiny revenues of this lean period is given by Elizabeth Monroe, in "The Shaikhdom of Kuwait", *International Affairs*, Vol. XXX, No. 3, July 1954, p. 271.

[22] Royal Institute of International Affairs, *op. cit.*, p. 121.

[23] Monroe, E., *op. cit.*, p. 276; see also Hay, Sir Rupert, "The Impact of the Oil Industry on the Persian Gulf Shaykhdoms", *Middle East Journal*, Vol. 9, No. 4, Autumn 1955, p. 366.

[24] Royal Institute of International Affairs, *op. cit.*, pp. 126-127.

[25] Road-building, not only in the town, but along the coast and to Basrah, is very necessary, for prosperity has brought much traffic. It was said by the Shaikh in charge of the Public Works Department that there were 30,000 cars in the city in 1954 (De Candole, E. A. V., *Royal Central Asian Journal*, Vol. XLII, Part I, January 1955, p. 22).

[26] Royal Institute of International Affairs, *op. cit.*, p. 128.

[27] There were 1473 visits by local craft and 535 by foreign steamers, excluding tankers, in 1954, according to the Bahrain Government Annual *Report* for that year.

[28] Figures quoted in Bahrain Petroleum Company Ltd. publication, "Bahrain", 1952.

[29] Figures in this paragraph and quotation are from Bahrain Government Annual *Report* for 1954 which includes 1955 estimates.

[30] *Commerce du Levant*, 15 June 1955.

[31] Education section of Bahrain Government Annual *Report*, 1954.

[32] Hay, Sir Rupert, *op. cit.*, pp. 369-370; there is also a note on the beginnings of an administrative system in Liebesny, H. J., "Administration and Legal Development in Arabia—the Persian Gulf Principalities", *Middle East Journal*, Vol. 10, No. 1, Winter 1956, pp. 33-42.

[33] Royal Institute of International Affairs, *op. cit.*, p. 81; also the Aramco publication, "The Arabia of Ibn Saud" by Lebkicher, R., Rentz, G. and Steineke, M.

[34] Royal Institute of International Affairs, *op. cit.*, p. 82; Aramco, *op. cit.*, p. 95; and other sources.

[35] Described in Aramco, *op. cit.*, p. 102.

[36] *Petroleum Press Service*, "Saudi Arabia Overspends", Vol. XXII, No. 4, April 1955, p. 139.

[37] Philby, H. St. J., "Saudi Arabia", p. 333.

[38] Budget percentages based on *Petroleum Press Service*, *op. cit.*, p. 139.

[39] Described in detail by Sanger, R. H., "The Arabian Peninsula", pp. 58-72 and by Ellis, H. B. in *The Christian Science Monitor*, 14 June 1954.

[40] Ellis, H. B., *The Christian Science Monitor*, 5 April 1954.

[41] *The Economist*, 27 February 1954.

[42] Royal Institute of International Affairs, *op. cit.*, p. 111.

[43] Statement issued by Iraq Petroleum Company Limited in November 1955.

[44] Royal Institute of International Affairs, *op. cit.*, p. 488.

[45] United Nations *op. cit.*, p. 181, which estimates that nearly half the national income was contributed by agriculture in 1950. The same source gives details of development achieved.

[46] For historical details of wartime activities see Cooke, H. V., "Challenge and Response in the Middle East", pp. 156-157.

[47] Barakat, Dr Awad, "Recent Economic Developments in Syria", "Middle East Economic Papers, 1954", p. 8.

[48] "The Economic Development of Syria, 1955".

[49] Discussed more fully in *Petroleum Press Service*, Vol. XXI, No. 10, October 1954, pp. 388-389.

[50] Grassmuck, G., and Salibi, Kamal, "A Manual of Lebanese Administration", pp. 89-90, which also gives useful information on the budget, p. 17.

[51] This complicated scheme cannot be described succinctly: see, however, United Nations, *op. cit.*, p. 174.

[52] Royal Institute of International Affairs, *op. cit.*, p. 350, *et seq.*

[53] Monroe, E., "The Arab-Israel Frontier", *International Affairs*, Vol. XXIX, No. 4, October 1953.

[54] Baster, J., "The Economic Problems of Jordan", *International Affairs*, Vol. XXXI, No. 1, January 1955, p. 30.

[55] Baster, J., *op. cit.*, p. 33.

[56] Royal Institute of International Affairs, *op cit.*, p. 220.

[57] All balance of payments figures are from the International Monetary Fund "Balance of Payments Yearbook", Vol. 5, 1947-1953. The Fund system of calculation does not show State revenues from oil and local expenditures of petroleum companies as separate items in the main table for Iraq, but values the oil exports and includes on the debit side figures for the imports of oil companies and estimate of the transfer of profits abroad. The actual receipts are, however, given in a subsidiary table and balance with the credit item mentioned.

Part VI Problems and Planning

The acquisition of wealth by states and individuals always brings problems (though not, it seems, sufficiently great to cause them to spurn it); the Middle East countries benefiting from oil revenues are no exception. Though most recognize that spending must not be haphazard, it is only dimly realized that there are difficulties from the outset in its pace and control. To draw up a development programme does not necessarily mean the immediate achievement of development spending; administrative inexperience and the relative inefficiency of Government machinery in the Middle East make quick productive expenditure, never easy in the best organized countries, more difficult; some planners, too, seem to be afflicted by a psychological hesitation in bridging the gap between thought and action. Moreover, even plans based on sound economic concepts, properly administered and carried out efficiently by those with the will to succeed, are hampered by lack of technical data about the region; soil surveys, the collection of climatic information, the assessment of water duties, agricultural research, mineral surveys —all these have not yet given the complete picture of the basic scientific facts.* The pace may, therefore, be too slow for the anxious ambition of those younger men who demand, among other things, extraordinary speed and efficiency from Western advisers and contractors, though not always collaborating to produce it. An apparent lack of results may therefore cause discontent; if on the other hand money is spent rapidly with a lavish hand mistakes may be made in actual projects or economic disorders such as low purchasing power, incapacity for capital formation and trade unbalance may be replaced by the fevers of extravagant spending or inflation; this last is not however a serious menace in the producer states since the large acquisitions of foreign exchange have permitted increased consumer as well as capital imports.**

Not all the Middle East countries, moreover, even if they solve the problems of administrative capacity, technical information, and control of pace inherent in the actual process of spending, will find it easy to select the right things on which to spend. Opportunities of course differ and it is inevitable that in Kuwait or Qatar, for example, much of the money must go into improving the conditions of life. This is non-productive expenditure in the economic sense though highly so in the social; if the burden which the State has thus shouldered is to be carried easily in a day without oil revenues there must also be capital investment outside the country, which itself provides no opportunities for it. Sheer waste, as is partly happening in Saudi Arabia, is of course no solution at all: "unless the current income . . . is partially used in creating durable physical capital and an improved human element, the future generations will have to suffer the heavy burden of the extravagance and short-sightedness of their forebears."[1] Given a programme of capital investment, however, accompanied by a reasonable current spending on social improvement and an inflow of consumer goods to keep inflation down, the question also arises of the nature of the projects to which this investment is directed. Two points of particular importance may be made; first, in the words of Professor Langley[2] "the best may be the enemy of the good in a very real sense" if, in the example he gives, money is concentrated on building super-highways and cheap access roads to agricultural areas are neglected. Secondly, too many countries regard industrialization as the be-all and end-all of progress; it is true that the rise in living standards in the West and the growth of population have been parallel historically to industrial revolutions and that there is a clear correlation between energy consumption and national income per head. But it should not be forgotten that some of this energy is consumed in making agriculture more efficient and that industrialization is only vital to countries which are over-populated in relation to their land resources. In Iraq, at least, this is not the case; generally, the Middle East is an agricultural area and such industrial development as takes place must be largely based on the prosperity of agriculture,[3] for it must arise naturally out of the raw materials available, which are mostly agricultural products. Such industry as is developed need not, however, necessarily be private; in the past there has been a tendency, particularly in Iraq and Iran, for the State to participate in industrial development to an unusual degree since there is a scarcity of domestic capital.*

Capital by itself is of course not enough, as Professor Frankel has pointed out.[4] Investment in the type of project which will ensure that the national income is not merely immediately raised but goes on growing is certainly essential; but it will not be effective without a general spread of technical education and a social change which goes far beyond the mere revision of systems under which absentee landlords or the privileged wealthy tend to hold back development. The whole society must readjust itself as part of the progressive process; in the widest sense this means the spread of education—not merely formal but social. Such a change is only just beginning; much more obvious are the strains and stresses of the general social ferment caused by the impact of the West of which the oil industry and the results of oil revenues are only a part; this has already produced what Albert Hourani[5] in a justly well-known definition describes as "Levantinism"—the dangerous state of living in "two worlds or more at once without belonging to either."

* The situation is however better today than it was when in 1949 Appendix III to the *Report* of the United Nations Economic Survey Mission for the Middle East listed the many fields in which preliminary survey and technical advice were needed ("Final Report of the United Nations Economic Survey Mission for the Middle East" Part I, pp. 61-65).

** The import of consumer goods sufficient to offset the rise in the national income resulting from development expenditure must be nicely balanced; Professor S. J. Langley in an article on "Oil Royalties and Economic Development in the Middle East" in "Middle East Economic Papers, 1954" points out that there is a link between the level of oil revenues and the domestic spending that can be safely carried out. He believes that the ratio between internal expenditure and the induced level of imports in Iraq at least may be such as "to permit somewhat more liberal spending than is being currently planned. The development programme should be geared to the needs of the country and the availability of resources and materials; if this is too large, the foreign balance will soon begin to fall. If on the other hand the foreign balance rises there is a clear indication that more development outlays could safely be made". (Page 101).

* An American economist (E. Staley, "The Future of Underdeveloped Countries" pp. 242-243) indicates that better management of industry is not necessarily to be achieved by transferring government industries to private ownership. "Good management in private enterprise no less than in government, is a social product. Private management, on the whole, is as backward in most underdeveloped countries as public administration".

"Marked progress"[6] has been made in the economy of the Middle East in the post-war years; and the funds for further development are likely to continue since the region is the main source of Western Europe's oil, and as energy requirements rise the demand for it should continue to go up. The immediate benefits of this, however, have been somewhat hampered by the physical difficulties and the two major social complications mentioned above; on a regional basis the development is also less easy because the wealth is unevenly distributed. From this fact has grown the concept of an Arab Development Bank or Middle East Development Corporation, which might use the surplus revenues from states which cannot spend it all for the benefit of those which have the potential but not the funds. Such reasoning is highly attractive to the Have-not states though it is perhaps not so popular with the Haves; it is not also without attraction to those Powers interested in the stability of the region as a whole. But whether or not this dream comes true, it is clear that the impact of oil on the Arab Middle East is already on balance productive and important, though perhaps also disturbing and uneven.

References

[1] Badre, A. Y., "The Economy of the Contemporary Arab World", "Middle East Economic Papers, 1955", p. 20.

[2] Langley, S. J., "Oil Royalties and Economic Development in the Middle East", "Middle East Economic Papers, 1954", p. 95.

[3] See Murray, K. A. H., in a paper in the Transactions of the Conference on Agricultural Development of the Middle East held in 1944, p. 198.

[4] Frankel, S. H., "The Economic Impact on Under-developed Societies", p. 95, in a scathing commentary on the United Nations 1951 report, "Measures for the Economic Development of Under-developed Countries". Elsewhere (p. 72) he points out that the general opinion that the construction of a development machinery and the provision of capital are sufficient to take the under-developed countries to the new millenium, is not necessarily correct, for cash is not the only type of capital which is required: it is necessary to use all types of human capital—skills, the general social heritage—to achieve the goal without disharmony. Planning alone is also not enough: there must be "piecemeal adaptation of individuals to goals which emerge but slowly" for human beings "are not a medium of artistic expression; except for tyrants" (p. 94). Similar points are made by Nurkse, R., "Problems of Capital Formation in Under-developed Countries", p. 16. Both these books and Lord Salter's report to the Iraq Government should be made prescribed reading for planners.

[5] Hourani, A. H., "Syria and the Lebanon", pp. 70-71. See also Patai, R., "The Dynamics of Westernization in the Middle East", *Middle East Journal*, Vol. 9, No. 1, Winter 1955, pp. 1-16.

[6] "Economic Developments in the Middle East, 1945-1954", p. 1. United Nations.

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New IP Publications

Refining Safety Code

Recently the third part of the Model Code of Safe Practice in the Petroleum Industry has made its appearance. Entitled the Refining Safety Code, its purpose is to provide a general guide to safe practice in petroleum refineries and it gives, for the most part, recommendations for safe practice rather than a set of rigid rules. Those sections dealing with safety distances, capacities of bunded areas, and other debatable issues will be found to be especially interesting.

The standards of safety laid down in the Refining Safety Code must come second to statutory requirements and care has been taken to point out that the code must be considered as complementary to these requirements.

The recommendations given in the Refining Safety Code are based almost entirely on lessons learned over many years of practical experience. It will be seen from the following Summary of Contents that the scope of the Code is wide but it is confidently considered that all safety aspects in petroleum refining have been covered and that the contents of the publication will give the authoritative guidance which has been a long felt need:

Definitions—General Precautions—Bulk Loading and Unloading—Bulk Storage.

Process Units—Dangerous Chemicals—Laboratories.

Packaging—Liquefied Petroleum Gases—General Refinery Services.

Fire Fighting Services—Breathing Apparatus.

This new code is printed as a loose-leaf booklet of 55 pages punched for insertion in the standard binder provided for the IP Codes. Price of the Refining Safety Code alone is 12s. 6d., post free; if the binder is required also, the cost of code and binder is 28s. 0d. IP members may purchase one copy of the Code for 10s. 6d. or the Code and the binder at 26s. 0d.

Library Catalogue

The Library Sub-Committee of the IP have long realized that the value of the Library maintained at headquarters would be much enhanced if members could be furnished with a catalogue of its principal contents. Much thought was given to the form which such a catalogue should take and eventually it was decided that the classification devised by Professor Lester G. Uren offered considerable advantages for a library devoted to petroleum and allied substances.

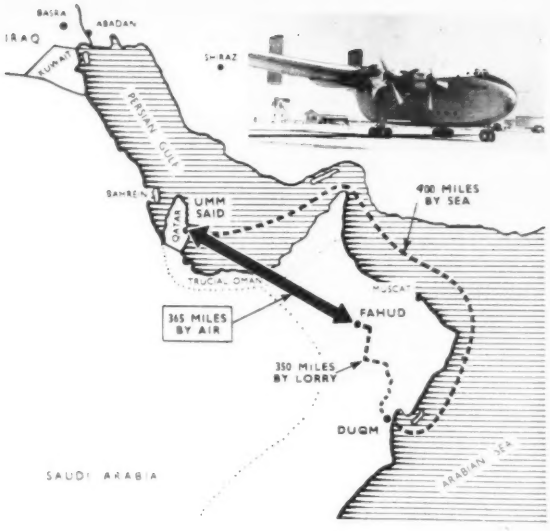
The task of re-classification was not a simple one and the members of the Library Sub-Committee and the librarian spent many hours on this work. The culmination of their efforts has resulted in the publication this month of the IP Library Catalogue. Its 87 pages are a veritable mine of information on the literature of petroleum and, although it is not suggested that it lists all the world's petroleum books, it is felt that it provides a valuable tool for the searcher after petroleum knowledge.

To members of the IP, copies are available on request. In view of the importance of this publication, it has been decided that non-members of the IP may purchase copies at 7s. 6d. each. A remittance should accompany the order.

Air Transport Feat

in

South East Arabia

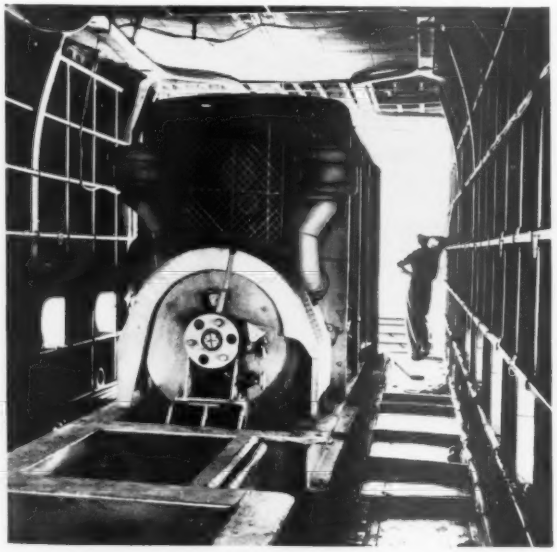


An unusual transportation problem faced by the Iraq Petroleum Company during recent prospecting work in South East Arabia, was solved successfully with the aid of a Blackburn "Universal" air freighter and aircrew from Hunting Clan Air Transport.

The possibility had arisen of a valuable "strike" in a desolate region almost inaccessible by ordinary means of transport, and the problem was how to transport heavy oil drilling equipment from the equipment base at Umm Said in the Qatar Peninsula to Jebel Fahud in the Sultanate of Muscat and Oman.

Barriers of desert and mountain, and political unrest in the Buraimi Oasis area, meant that the only practical land access to Fahud was from Ras Duqm on the south coast, involving a 900-mile journey by sea from Umm Said followed by a 300-mile journey across the desert. The rough nature of the overland track and the need to transfer loads off-shore to landing craft because of shallow water at Ras Duqm, meant that the use of this route would be a difficult and lengthy undertaking. Moreover, although personnel, camp materials, and stores could be carried this way, specially-designed transport would be required to move the heavy drilling equipment overland.

Part of the equipment aboard the air freighter.



Choice of Aircraft

In considering air transport, selection was limited to aircraft which could use the rough airstrip of rocky desert at Fahud. Dakotas and Bristol Freighters were found suitable to assist the overland movement by carrying personnel and the more valuable equipment, but these could not handle the large indivisible loads of heavy equipment.

This task was assigned to the Blackburn "Universal", civil version of the Blackburn "Beverley" in production for R.A.F. Transport Command, which has a payload of 22 tons and is able to operate from crude airstrips. This aircraft, 99½ft in length and 37½ ft high, has a freight compartment measuring 40 × 10 × 10 feet. With this capacity it was able to transport 129 tons of heavy equipment over the 365-mile air journey to Fahud in only nine flights.

The following schedule of the operation shows the magnitude of the task and the dispatch with which it was carried out.

Date	*Total Payload (Long tons)*	*Main Item*	*Weight (Long tons)*	*Dimensions*		
				Length ft. in.	*Breadth* ft. in.	*Height* ft. in.
Nov 5	10¼	Paxman engine ...	8¼	22 6	5 8	8 6
6	10	.. ..	8¼	21 0	5 8	8 6
7	14½	.. ..	10	19 6	5 8	8 6
8	15	.. ..	9	19 6	5 8	8 6
		Transmission unit ...	4½	13 0	7 4	3 7
9	15½	Rear half drawworks ...	12	22 0	7 0	7 9
10	16	Base for slush pump with '300 ton' travelling block and hydraulic brake mounted on it...	10½	26 0	7 2	6 2
12	15½	Base for slush pump with rotary table and crown block, etc., mounted on it ...	13½	20 6	7 2	5 7
13	15½	Mud tank	10½	28 0	8 7	7 8
		Shaker (vibrating filter)	3½	11 3	7 4	3 7
14	16½	Front half drawworks...	16½	21 11	8 3	7 5
	129					

Oil Fuel in Factory Equipment

With the prospect that Britain's expanding industrial demands for heat and power will outstrip its internal fuel resources by between 50 and 60 million tons by 1960 and by from 75 to 125 million tons in 1974, it was fitting that the centrepiece of the 1956 Factory Equipment Exhibition should be devoted to oil burners. It is the oil industry that will be called upon to supply the fuel to fill the gap, however large it may be, and it was on the invitation of Shell-Mex and BP Ltd, in collaboration with oil burner, boiler, and heater makers and the organizers of the Exhibition, that the central feature—Oil Fuel in Industry—was staged.

It is estimated that within the next few years one quarter of today's industrial and commercial coal users will find it expedient or necessary to change to oil fuel for heating and steam raising.

The exhibit occupied 12,000 square feet of floor space, cost £15,000 to build, and included over 150 exhibits from more than 70 manufacturers of appliances for the efficient combustion of oil fuel. All types and sizes were included, from burner heads weighing a few ounces up to units capable of producing nearly 200,000 lb of steam per hour.

The Exhibition was formally opened by Peter Thorneycroft, President of the Board of Trade, and in thanking him for his courtesy in doing so, C. M. Vignoles, managing director of Shell-Mex and BP Ltd, appealed to the Government to give some aid to the manufacturers of oil burners. He said: "The use of oil on the scale necessary to enable the country to solve the fuel problem will throw an immense burden on the equipment manufacturers.

"Theirs is a virile industry and an expanding one. But it is made up of relatively small concerns with fairly limited resources. These firms are facing a great challenge as well as a great opportunity.

"Their difficulties can hardly be exaggerated. Their maximum effort will be made in an overloaded economy in which full employment has reduced the mobility of labour and freedom to manœuvre to vanishing point.

"Their work may well be impeded by shortage of steel. Yet somehow they must obtain the necessary raw material and machine tools, and train the required skilled labour to convert what has always been a craftsman's industry to quantity production.

"The ingenuity and determination which they are showing surely demand—and deserve—that no obstacle should be placed in the way of their search for the wherewithal to finance this essential development.

"This nation of ours has within its confines many great industries and it has relied for its pre-eminence over the years—and will in the future—on the endeavours of a host of small but vigorous enterprises.

"Here we have the case of one section of industry, compounded of small units, charged with a task on which our immediate industrial future will largely rest. It would be tragic if, for want of the ha'porth of tar, the ship should not merely be spoiled but quite possibly sunk as well.

"We in Shell-Mex and BP Ltd", continued Mr Vignoles, "are very proud of our long history of successful co-operation with British oil-burner manufacturers, and of the part we have played in helping them to make the striking advances in design of which the latest examples are on exhibition here".

The firms associated with Shell-Mex and BP Ltd in the composite exhibition were:

Afos Ltd
Air Heating Ltd
Ashwell & Nesbit Ltd
Associated British Combustion Ltd
Auto Combustions (London) Ltd
Automatic Heat Systems Ltd
Babcock & Wilcox Ltd
John P. Barlow
Beeston Boiler Co Ltd
Bentone Oil Burners
Bottogas Ltd
Bratt Colbran Ltd
Brian Combustions Ltd
British Doby Stokers Ltd
British Oil Burners Ltd
Brockhouse Heater Co Ltd
Carricks (London) Ltd
Clyde Fuel Systems Ltd
C.N. Oil Burner Co Ltd
Combustions Ltd
Crane Ltd
C.T.C. Heat (London) Ltd
Thos. De La Rue & Co Ltd
Domestic Installations Co Ltd
Dragonaire Ltd
Felcoil Burners Ltd
Fisher Oil Burners
Flexaire Ltd
Franglo Products Ltd
W. Grocott
G.W.B. Furnaces Ltd
Harris Engineering Co Ltd
V. & N. Hartley Ltd
Hartley & Sugden Ltd
Hopes Heating & Engineering Ltd
Hubbard Combustion Ltd
Hydran Products Ltd
Ideal Boilers & Radiators Ltd
Janitor Boilers Ltd
Frederick Kay (Engineering) Ltd
Laidlaw Drew & Co Ltd
R. F. Landon & Partners
Alfred Langham
Joseph Lucas (GTE) Ltd
May Oil Burner (England) Ltd
Nu-Way Heating Plants Ltd
Parkinson & Cowan Industrial Products
Perkins (CME) Ltd
G. C. Pillinger & Co Ltd
Premier Heating Systems
Prior Stokers Ltd
Radiant Heating Ltd
Rudling (Liquid Fuel) Burners Ltd
Rutherford Oil Burners Ltd
Schieldrop & Co Ltd
Shorrock Superchargers Ltd
Spanner Boilers Ltd
Stinchcombe & Cooper Ltd
Sunrod Ltd
Swinney Bros Ltd
Tangyes Ltd
Thermofire Engineering Co Ltd
John Thompson Watertube Boilers Ltd
John I. Thornycroft & Co Ltd
Todd Oil Burners Ltd
Urquharts (1926) Ltd
Vaporheat Ltd
Verrolec Ltd
Viking Oil Burners
Wallsend Slipway & Engineering Co Ltd
Waterbury Ltd
Watts Automatic Boilers
Weatherfoil Heating Systems Ltd
Whites Marine Engineering Co Ltd
Henry Wilson & Co Ltd
Zephair Ltd

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TRADE LITERATURE

"Endewrance" High Alloys

Dewrance & Co Ltd, makers of boiler mountings and piping valves, have formed a Special Alloys Division to handle the Company's "Endewrance" High Alloys, their T.L.B. metal powder deposition process, and their powdered metals for high temperature brazing.

A new publication giving full details of "Endewrance" High Alloys can be obtained from the new Division.

KEL-F Printing Inks

A new brochure published by The M. W. Kellogg Company gives details of new fluorocarbon-type pigmented inks which are resistant to high temperatures and to chemicals. Known as KEL-F printing inks, they are suitable for marking nylon, fluorocarbon, and polyethylene surfaces and can be used on many rubbers and other plastics.

The inks are available either fully compounded or as a clear vehicle and separate pigment suspensions. They are of two types, air-drying and heat-setting, and can be applied by standard printing and marking methods.

Copies of the booklet are available on request to The M. W. Kellogg Company, Chemical Manufacturing Division, Jersey City, N.J.

Notes of the Month

Shell Scholarships in Austria

Shell is to play a part in overcoming the serious shortage of trained scientists in Austria by enabling more students to attend university.

Two scholarships, each worth £430, have been awarded by Shell Austria A.G., to enable students to spend six years at an Austrian university studying chemistry or an allied technical subject.

The first awards have already been made and two further scholarships will be awarded each year so that from 1960 onwards there will always be 12 Shell students studying at Austrian universities. There will be no obligation on the winners to join Shell at the end of their courses.

The Austrian Ministry of Education will collaborate in the selection of the scholars.

Society of Instrument Technology Ltd

The Society of Instrument Technology Ltd has set up permanent headquarters at 20 Queen Anne Street, London, W.1. Commander A. A. W. Pollard, D.S.C., R.N. (Retd.), has been appointed full-time Secretary of the Society.

All correspondence should now be addressed to the new headquarters except that which affects the editorship of the Society's Transactions.

ABCM Research Committee

A Chemical Engineering Research and Advisory Service Committee has been set up by the Association of British Chemical Manufacturers as a result of the DSIR Report of the Cremer Committee on chemical engineering research.

Chairman of the Committee is E. W. Greensmith of Imperial Chemical Industries Ltd. The ABCM members are Dr J. W. Barrett of Monsanto Chemicals Ltd, F. Mackley of Shell Chemical Company, K. Piercy of Albright and Wilson Ltd, Dr F. Roffey of Distillers Company, and B. E. A. Vigers of Laportè Chemicals Ltd.

Glass Extension for Grangemouth

BP's Grangemouth refinery is to have a glass extension to its power station to house a new 6.25-megawatt turbo-alternator. This will break up the brick walls of the power station and the alternator will be visible from the road.

Other construction work will include two outside boilers and a 130-ft chimney added to the two existing chimneys of the power station.

The total cost of the scheme is estimated at £825,000 and the project is expected to be completed by the end of 1956.

Welding Symposium

A symposium and demonstration, sponsored by ICI, on the welding of heat-exchanger components in copper alloys was held at The Royal Horticultural Society's Old Hall, London, on 5 April.

The Chairman (Dr N. P. Inglis), in his opening remarks, said there had been great developments in the field of non-ferrous welding in recent years. As the largest manufacturers of non-ferrous metals in the Commonwealth, ICI were anxious to demonstrate their worth. They were also anxious to keep up-to-date with the needs and wishes of the oil industry and to learn in what direction might lie the future demand for non-ferrous materials for fabrication and welding.

The following papers were presented at the meeting: "Possible Advantages of Seal-welding of Non-ferrous Heat-exchanger Tube Ends." By Ir. L. J. P. Smulders. "Condensers Cooled by Sea Water." By E. D. Dolan. "Floating Head Covers—The Alternatives." By R. H. Meeker. "Copper Alloys Most Suitable for Heat Exchanger Construction." By W. H. L. Hooper. "Which Welding System to Choose. By D. C. Moore.

Improvements at Lagos

Improvements costing £1,050,000 have recently been completed at the Nigerian port of Lagos as part of a project to expand the distribution of petroleum products throughout British West Africa.

Shell's new Apapa Main "All-Product" Installation consisting of 14 tanks will be the chief distributing centre for the whole of Nigeria. The installation covers an area of 35 acres of reclaimed swamp land. It was officially opened by the Federal Minister of Trade and Industry during April.

Another improvement at Lagos is a bulk bitumen installation begun by Shell in 1954, which will make it easier to import into Nigeria bulk quantities of bitumen from the Netherlands West Indies. Imports of bitumen are particularly necessary to provide good road surfaces in Nigeria.

Further evidence of Shell's increased trading activities in

Esso Petroleum Company's 1070-*dwt bunkering tanker, "Esso Poole", delivering fuel oil from the Esso refinery at Fawley to the new Central Electricity Authority power station at Marchwood. A daily supply service to the power station was begun on* 29 *December last year and "Esso Poole" will be largely responsible for maintaining supplies. She can discharge her cargo of* 1200 *tons of fuel oil at a rate of* 500 *tons an hour and will also be used to bunker the "Queens".*

Nigeria is given by the opening of Shell's new West African Head Office on the waterfront at Lagos to replace now inadequate rented accommodation.

Shell Exports in 1955

During 1955 materials and equipment worth £40 million were exported from the U.K. by the Royal Dutch Shell Group of oil companies for their operations overseas. This was £9 million more than in 1954.

Another £10 million was spent on plant and stores for refineries in the U.K. and £18 million on the construction, repair, and victualling of the Shell tanker fleet.

British shipowners as well as British suppliers benefited from Shell's activities, £3 million being paid in freight charges during the year for the shipment of some 236,000 tons to over 100 different countries.

Japanese Deep-drilling Project

The Teikoku Oil Company has purchased a Type 110 rig from the National Supply Company for deep drilling work in the Higashi Nagaoka area of Japan.

Present wells in Japan have a maximum depth of under 6000 feet and the decision to seek oil at greater depths is the result of studies begun by American technicians during the Allied occupation and subsequently carried on by The Teikoku Oil Company.

The Teikoku Oil Company, which was set up by the Japanese Government before the second world war, is owned half by the Government and half privately. The Company is a participant in the recently-formed Japan Petroleum Exploration Co Ltd, owned half by the Government and half by a consortium of oil companies, but The Teikoku Oil Company is to use the new rig for exploration in its own area.

Change of Name

The name of Trinidad Leaseholds Limited has been changed to the Trinidad Oil Company Ltd. The address of the Company is unchanged.

A BP photo

Members of the Australian Test cricket team who are now in England visited BP's Kwinana refinery in Western Australia before leaving on their Test tour. Here they are seen listening to an introductory talk in the Kwinana refinery visitors' room.

A new "Shell" dispenser for aviation hydrant fuelling, designed by Thompson Bros. (Bilston) Ltd in co-operation with the Shell Petroleum Co Ltd and constructed from "Beetle" resin supplied by BIP Chemicals Ltd.

BP Tanker in Rescue Drama

A fireman-greaser of The British Tanker Company's *British Patriot* played an important part in the rescue of the occupants of a cabin cruiser which caught fire after fuelling at Adelaide, South Australia.

Six men jumped overboard when the cabin cruiser caught fire and a lifeboat was launched from the nearby *British Patriot* to rescue them. Meanwhile a fireman-greaser, John Henderson, had dived into the water. He pushed a lifebuoy to three of the men and supported a fourth until the lifeboat could pick up the four men and himself. The other two men were rescued by a harbour launch.

The four men picked up by *British Patriot* were given treatment for their burns in the tanker's hospital.

Egmanton Oil

BP's Egmanton oilfield in Nottinghamshire is now producing about 1000 tons of oil each month from six wells. A seventh well is now being drilled and plans are under way for the drilling of two others.

Change of Name

Shell-Leaseholds Distributing Company Limited and Petroleum Marketing Company (West Indies) Limited have recently changed their names to Shell & Regent Distributors (Trinidad) Limited and Shell & Regent Petroleum Distributors (West Indies) Limited. The change has been made in order that the names of the companies shall be more closely associated with "Shell" and "Regent" products which they have been distributing for the past 20 years in parts of the West Indies. No change in operations or policy is involved.

P & O Tanker Chartering Arrangements

It is announced that chartering arrangements for the tankers which are to be built for the P & O and Associated Companies, will be handled on behalf of the owners by Birt, Potter, and Hughes, of 138 Leadenhall Street, London E.C.3.

Corrosion Conferences

The first congress of the European Federation of Corrosion, organized by the Société de Chimie Industrielle, is to be held in Paris from 22 November to 3 December—during the Convention of Chemical Engineering and the IVe Salon de la Chimie.

Another corrosion meeting will take place in May 1957 at Essen when the Corrosion Convention 1957 of the Arbeitsgemeinschaft Korrosion is held. The convention will deal with passivation and the formation of covering layers in the atmosphere and in water.

Acheson Colloiden N.V.

This company has been formed in Holland by Acheson Colloids Ltd to undertake production of fine dispersions at a new factory now being constructed at Scheemda.

Groningen. The factory will be completed in the autumn and its capacity is stated to be sufficient to meet growing demands for "dag" products in Western Europe.

British Oil Burner Manufacturers' Luncheon

Principal guest at the annual luncheon of the British Oil Burner Manufacturers' Association held during May, was David Renton, Q.C., M.P., Parliamentary Secretary to the Ministry of Fuel and Power.

The luncheon was well attended and among the guests were many representatives from the oil industry, including Sir Leonard Sinclair, chairman of Esso Petroleum Co Ltd, and C. M. Vignoles, O.B.E., managing director of Shell-Mex and BP Ltd.

In a speech following the luncheon, Mr Renton referred to the Government's target of trebling black oil consumption during the next five years. He said that the Government was not looking to the oil industry just to provide a fixed quantity of oil over a certain number of years and to the oil burner manufacturers to make the appliances to burn it. The producers of a fuel and of the means by which it was converted into energy could and should create the demand for it. He praised the excellence of the oil burning equipment which he had seen displayed at the Factory Equipment Exhibition and said that the number of people who were changing over to oil was increasing every day. By the efforts and enterprise of the oil burner manufacturers, it would increase even more rapidly.

At the annual general meeting which preceded the luncheon, J. R. C. Boyce of British Oil Burners Ltd, was elected president of the Association for a third year.

Water Research

The recently-formed Water Research Association which has set up offices and laboratories at Redhill, Surrey, is now engaged on a number of projects. Among them is fundamental research on adsorption phenomena as related to filtration problems.

Research director of the Association is Dr R. G. Allen, B.Sc., Ph.D., F.Inst.P.

Esso Research Company

Esso Petroleum Co Ltd has announced that the name of its research affiliate company in the U.K. has been changed from Esso Development Co Ltd to Esso Research Ltd. The Company's new name will reflect more accurately its expanding research activities.

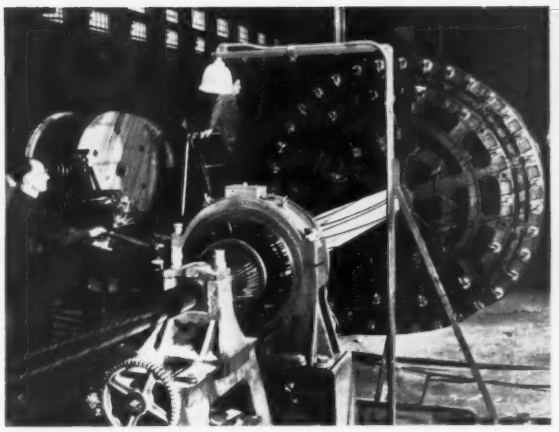
Esso Research Ltd will continue to co-operate with the Esso Research and Engineering Company in the U.S.A. in research work on behalf of the British, European, and North African affiliates of the Esso Group.

The Company's head office will remain at 33 Davies Street, London, W.1, but to conform with the Company's change of name the address of the Laboratories will be changed to Esso Research Limited, Abingdon, Berkshire.

Further Developments at Lake Maracaibo

Further development schemes are now being carried out by Compania Shell de Venezuela in the area of Lake Maracaibo. Last year saw the completion of a £2½ million pipeline linking the oil wells with the loading terminal at Palmarejo. Now a £1½ million scheme is under way to provide electric power for the production stations.

The new scheme involves the laying of two 17 mile-long 33,000-volt submarine cables, the largest of their kind in the world. They will run from the power station at Las Morochas on the eastern shore to a step-down transformer station to be built on piles sunk in the Lake bed some 17 miles to the south-west. From there, power will be distributed by 11,500-volt submarine cables to the production stations built over the Lake, where it will be further "stepped-down".



One of the 33,000-volt cables being armoured with PVC sheathed wire of 0·232 diameter.

The 33,000-volt cables have been made by Siemens Bros & Co Ltd in 1¾-mile lengths to be joined by submarine joint boxes. Siemens are also to lay the lines from their cable-laying ship, the converted collier, s.s. *Dashwood*.

New Diesel Tug

The diesel tug *Jamoosa*, built by Richard Dunston Ltd for Petroleum Development (Qatar) Ltd, is to be used for handling large sea-going tankers and for buoy tendering in the Middle East.

Jamoosa is a twin-screw diesel tug powered by machinery supplied by The National Gas and Oil Engine Co Ltd.

FEDC

A Federation of Engineering Design Consultants has been formed to guide manufacturers in their design and engineering development problems, and to give them the means of making certain that their design requirements are in the hands of capable consultants.

The address of the Federation is St. Stephen's House, Westminster, S.W.1.

Drilling by Reverse Circulation

A drilling system for use in finding water and in the construction of foundation and piling was demonstrated at Dorking recently by Agelane Limited.

A 30-50 Hydro Rig was used to demonstrate the reverse circulation method of drilling wide-diameter holes without the need for casing or mud to support the walls of the hole.

In the reverse circulation system penetration is carried out by a slowly rotating scraper or other type of drill attached to a column of large-diameter drill pipe. The cuttings are sucked up this drill pipe by an efficient gravel suction pump and fed into an open pit filled with water

The 30-50 Hydro Rig

where they can settle. From the same pit there is a gentle flow of comparatively clean water into the annular space between the drill pipe and the walls of the hole.

The system leaves a clean sand face which allows the clean water to penetrate the porous formations, and this movement inwards prevents the face of the formation from collapsing. The bits used are designed to eliminate as far as possible any caving incident to withdrawal.

Drilling can be carried out by this method provided that an artificial water head of not less than six feet can be maintained on the natural water table. The resulting hole will stand provided it is kept full of fresh water.

The 30-50 Hydro Rig is a reverse circulation rotary unit which combines lightness with speed and simplicity of operation.

Antarctic Equipment for Tests in Norway

Sno-cat tractors were used by the Trans-Antarctic Expedition in tests held 7500 ft above sea level in Norway at the end of May. BP not only co-operated with this venture but also provided at its own expense all the petroleum fuels and lubricants.

Dr Vivian Fuchs, leader of the Expedition, and Mr David Pratt, the transport officer, were present at the tests, together with members of BP's research organization from Sunbury-on-Thames.

Activated Carbon Factory in N. Ireland

Activated carbons are to be produced from peat for the first time in the U.K. at a new factory in Northern Ireland.

A new company, CEA (Northern Ireland) Ltd, has been formed to operate the factory. The project was engineered by The British CECA Co Ltd of London and that Company will also be responsible for marketing.

Extensive surveys were necessary to ascertain the amount of peat available, and a new process using a high temperature fluid bed technique has been evolved to produce powdered decolorizing carbons.

"Freon"-powered Warning Devices

"Freon" fluorinated hydrocarbon manufactured by E.I. du Pont de Nemours & Co Inc is being used to power warning devices made by the Falcon Alarm Co of Summit, New Jersey. These include fog, signal, and guard horns, and automatic fire detector horns.

Mining and Metallurgical Congress

A preliminary announcement regarding the Sixth Commonwealth Mining and Metallurgical Congress, to be held in Canada in September-October 1957, indicates that an attractive and all-embracing programme is being arranged.

Meetings are to be held at Vancouver, Edmonton, Winnipeg, Toronto, Ottawa, Montreal, Quebec, and Halifax, and during the traverse of Canada it seems that every associated industry will be visited. Copies of the first brochure are obtainable from the IP.

CRUDE OIL PRODUCTION

	March	*Jan to Mar*
	Tons	
Iraq Petroleum Co Ltd	2,112,120	5,923,241
Basrah Petroleum Co Ltd	693,591	2,079,218
Mosul Petroleum Co Ltd	107,207	312,166
Qatar Petroleum Co Ltd	507,562	1,464,515
Iraanse Aardolie Exploratie en Productie Mij*	2,194,000	5,322,000
	Barrels	
Trinidad Petroleum Development Co Ltd	344,182	1,367,497

* The refinery throughput at Abadan of the Iraanse Aardolie Raffinage Mij for March was 853,000 tons, the total for January-March being 2,220,000 tons.

★ ★ ★

SITUATIONS VACANT

Air Ministry Works Designs Branch requires in London designer/draughtsmen for bulk petroleum storage and pumping installations experienced in one or more of the following:—(*a*) Storage tank layout and design (*b*) pumphouse and plant layout (*c*) development of pipeline schemes (*d*) hydraulic calculations. Technical training to O.N.C. standard required. Salaries up to £761 p.a. starting pay based on age, qualifications, and experience. Paid overtime. Long-term possibilities with promotion and pensionable prospects. Normally natural born British subjects. Write stating age, qualifications, employment details incl. type of work done, to any Employment Exchange quoting Order No. Borough 1005.

Esso Petroleum Company Limited have many opportunities for Science and Engineering Graduates, resulting from further development and expansion at Fawley Refinery.

TECHNICAL DEPARTMENT

CAT. CRACKING PROCESS ENGINEER
HYDRODESULPHURIZATION PROCESS ENGINEER
CHEMICAL TREATING PROCESS ENGINEER
UTILITIES PROCESS ENGINEER
LUBRICATION PROCESS ENGINEER
DISTILLATION PROCESS ENGINEER
EXPERIMENTAL CHEMIST

The above posts carry responsibility for studying and advising on process unit operations, planning, economic, and engineering design problems.

All these are regular progressive posts, with starting salaries ranging from the £600's for the younger newly qualified graduate to four-figure salaries for candidates with relevant industrial experience.

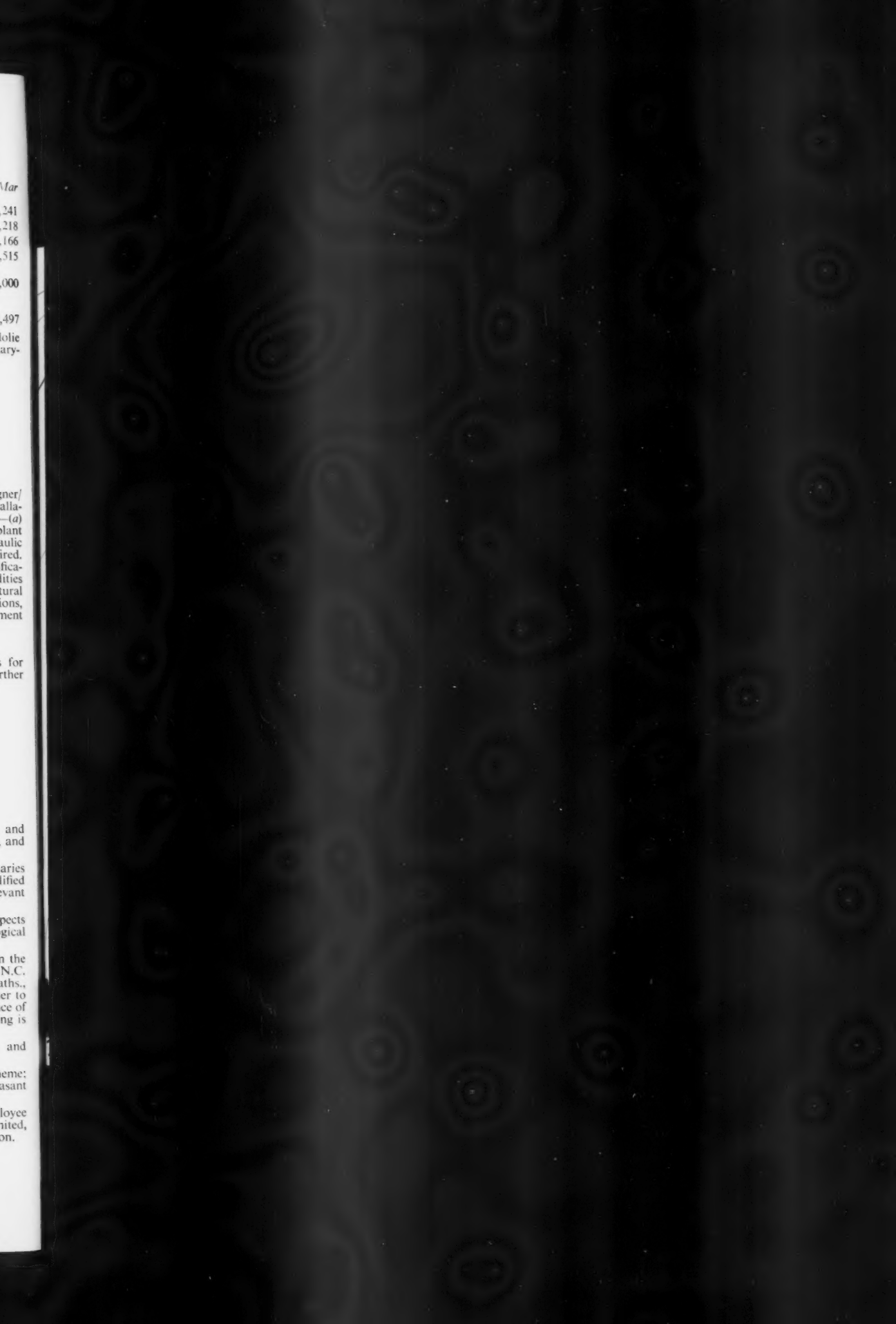
Continued expansion of the refinery gives excellent prospects for advancement. There are opportunities for technological and management training, where appropriate.

In addition there are a limited number of vacancies in the Technical Department for Assistants of Inter B.Sc. or H.N.C. standard. Applicants must have a good knowledge of Maths., an aptitude for calculations of a technical nature, in order to assist graduate engineers in their work. Previous experience of Chemistry, Chemical Engineering, Physics, or Engineering is essential.

Salaries are appropriate to age, qualifications, and experience.

There is an excellent and comprehensive Pension Scheme; recreational activities of all kinds are available in a pleasant rural area bordering Southampton Water.

Please send postcard for application form to Employee Relations Superintendent, Esso Petroleum Company Limited, Refinery Department, (Dept. IPR), Fawley, Southampton.



THE MATTHEW HALL GROUP

of Companies undertake engineering contracts in all parts of the world for the construction of oil refineries. The best of today's techniques backed by over a hundred years' engineering experience are available through the Group's designers, draughtsmen, technical buyers, administrators and engineers.

Oil refinery engineers

MATTHEW HALL

BP FUELS NORWAY'S FISHING FLEETS

THESE NORWEGIAN fishing boats are often out in the fishing grounds for weeks on end, covering many hundreds of miles during their stay at sea. On their return to their home fiords, the catch is landed, nets are repaired, and at places all along Norway's coasts BP oil fuel is pumped into the boats' fuel tanks.

The BP Shield is a familiar sight from the Arctic to the Antarctic. At sea, on land and in the air, BP makes an ever-growing contribution to the work and well-being of mankind.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON, E.C.2.

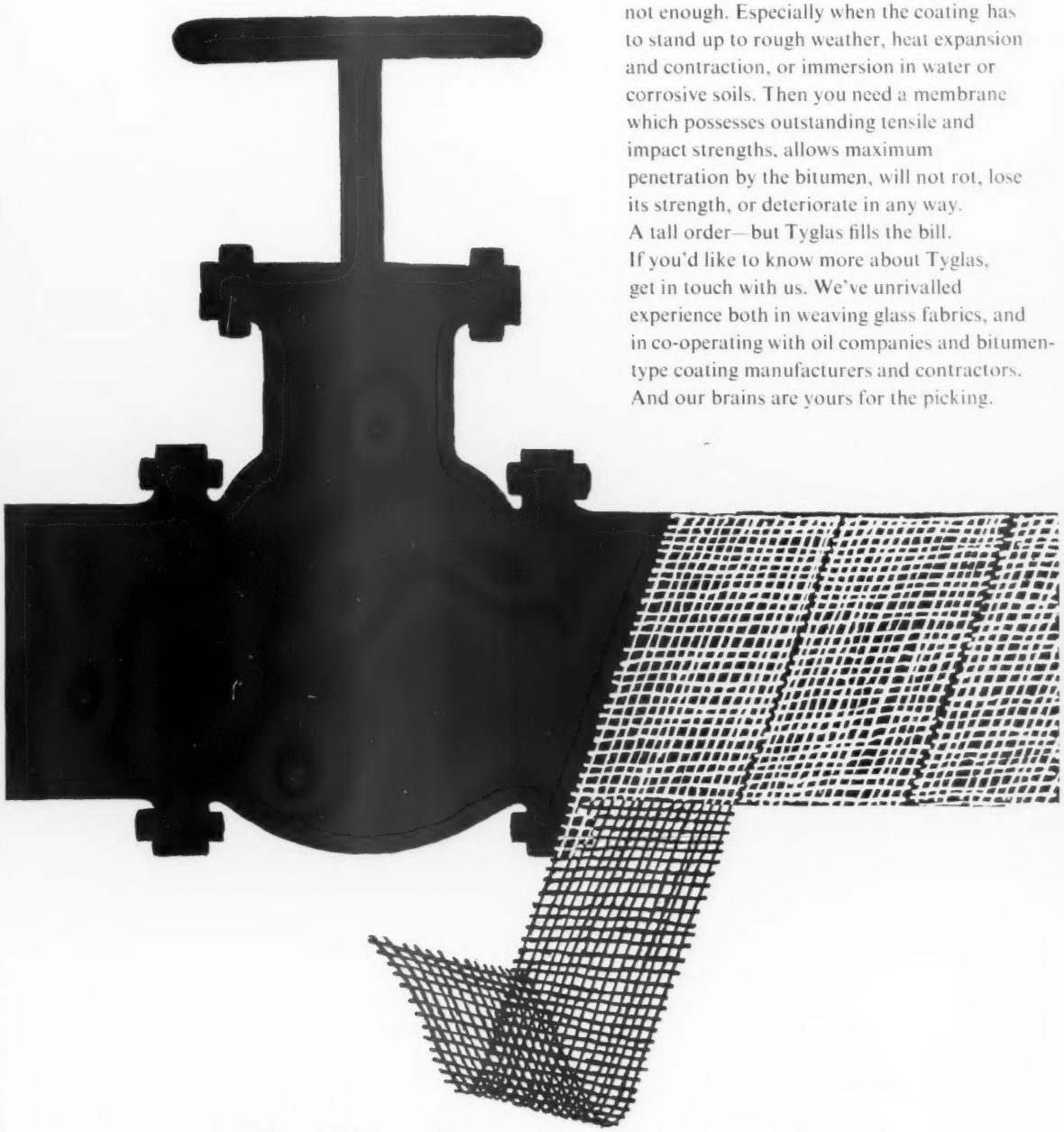
Wrapped any good pipes lately?

If it's the best reinforcement for bituminous protective coatings you're after—Tyglas is the name. Our Tyglas range of woven glass fabrics includes scrims specially designed for pipe-wrapping, waterproofing roofs, and coating marine piles.

Bitumen provides the best protective coating for all these. But bitumen alone is not enough. Especially when the coating has to stand up to rough weather, heat expansion and contraction, or immersion in water or corrosive soils. Then you need a membrane which possesses outstanding tensile and impact strengths, allows maximum penetration by the bitumen, will not rot, lose its strength, or deteriorate in any way.

A tall order—but Tyglas fills the bill.

If you'd like to know more about Tyglas, get in touch with us. We've unrivalled experience both in weaving glass fabrics, and in co-operating with oil companies and bitumen-type coating manufacturers and contractors. And our brains are yours for the picking.



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WOVEN GLASS FABRICS

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Makes good drums!

MOON BROTHERS LIMITED
BIRKENHEAD

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Changing Names

GARGOYLE
Industrial and Marine Lubricants

NOW **MOBIL**
Industrial and Marine Lubricants

It is already well known that the name of Vacuum Oil Company Limited has been changed to Mobil Oil Company Limited.

And now the name Mobil is replacing another very famous name: the name Gargoyle. Gargoyle Industrial and Marine Lubricants are now to be marketed as Mobil Industrial and Marine Lubricants.

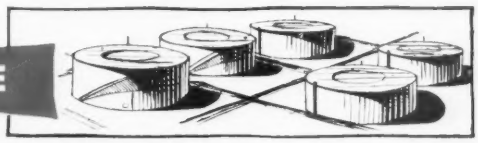
There had to be a good commercial reason for changing a name so well known and respected as Gargoyle has been throughout the world. The reason was this:

The present policy of the world-wide Mobil organization is to adopt one name for its products, so that the public will more readily recognise them as members of one family, and will hold them all in the high esteem that each has earned in its own field. The name Mobil has been chosen for the purpose because it is the one most widely associated in the public mind with the symbol of the Flying Red Horse. The name Mobil and the Flying Red Horse are already a most valuable recommendation for any petroleum product that bears them. By their present adoption for fine products in the Gargoyle range, the name, the trademark, and the products themselves, will all gain in reputation.

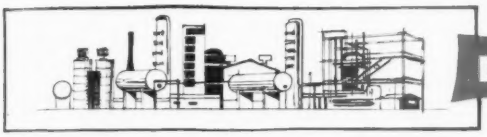
MOBIL
Industrial and Marine Lubricants

MOBIL OIL COMPANY LIMITED, LONDON, S.W.1

Eliminate Explosion Hazard on -

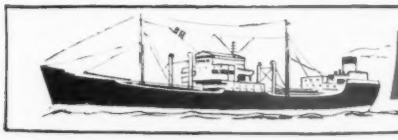


OIL STORAGE



DISTILLATION

TRANSPORT



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by using **HOLMES INERT GAS GENERATORS**

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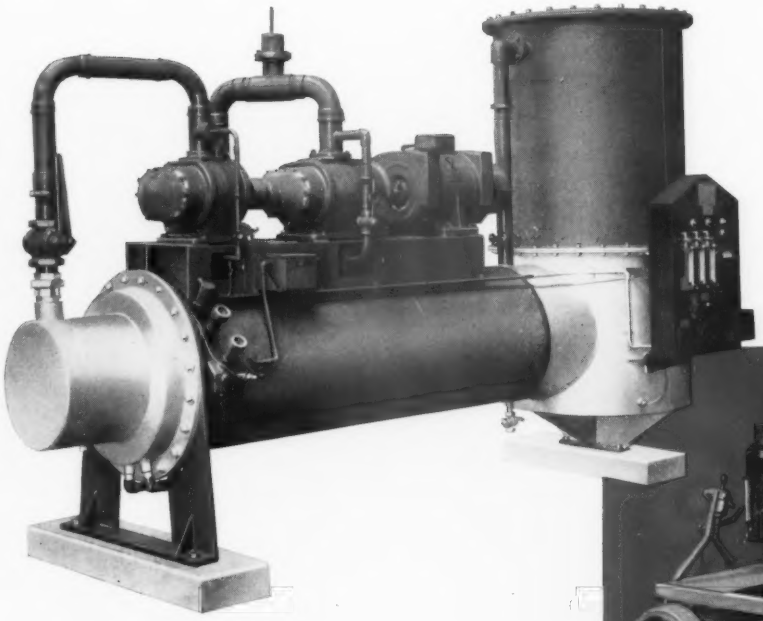

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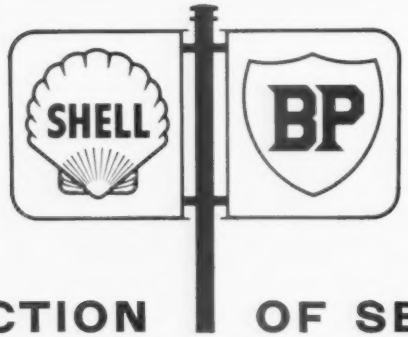
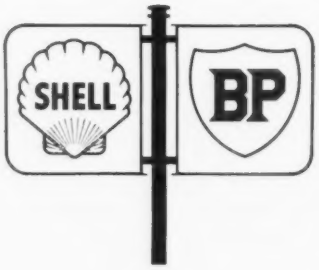
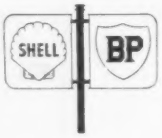


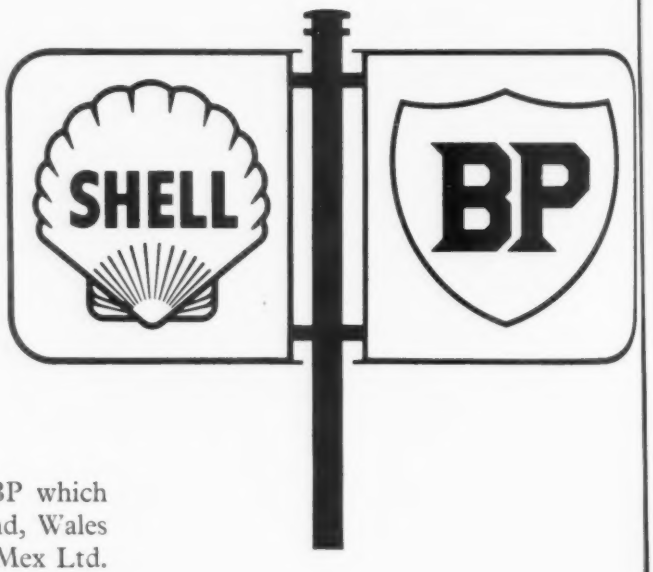
A SATISFACTION OF SERVICE-STATIONS



UNTIL this moment, there has never been a collective noun for a lot of related service-stations. For until recently, there has been no need for one in this country. Now there is. Shell and BP Stations are so numerous that a collective word has to be found. The most apt is a *satisfaction* of service-stations.

Why most apt ? Partly because of the quality of the products offered to motorists. And partly because these admirable products are offered everywhere — literally everywhere — motorists go in the British Isles.





This sign identifies the products of Shell and BP which are marketed by Shell-Mex & B.P. Ltd. in England, Wales and Northern Ireland; by Scottish Oils and Shell-Mex Ltd. in Scotland; and by Irish Shell Ltd. in the Republic of Ireland. Behind all these companies lie the vast resources of the Shell, BP and Eagle Groups.

British Standard Dimensioned Motors

for corrosive atmospheres

'ENGLISH ELECTRIC' class LYC British Standard Dimensioned motors have been designed specially for working in the Chemical, Gas and Oil Industries, or for any other place where there is a corrosive atmosphere.

LYC motors are fully described in publication DM/206.

- All external parts are cast iron covered with a special protective paint.
- Windings are of polyvinyl-acetal covered wire, quadruple dipped and baked four times in an insulating varnish.
- Cooling fan is of moulded plastic construction.
- Corrosive resistant rating plate.
- Competitive price and early delivery.

'ENGLISH ELECTRIC'

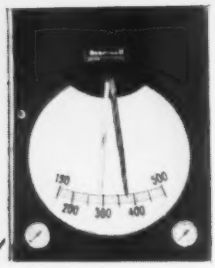
chemical motors

THE ENGLISH ELECTRIC COMPANY LIMITED, QUEENS HOUSE, KINGSWAY, LONDON, W.C.2

Industrial Motor Works, Bradford

WORKS: STAFFORD • PRESTON • RUGBY • BRADFORD • LIVERPOOL • ACCRINGTON

DM. 44H5

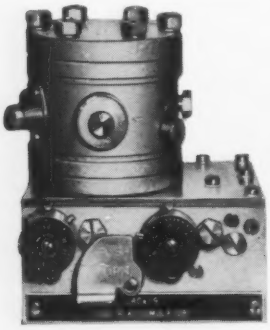


Pneumatic Pressure or Vacuum Transmitter.

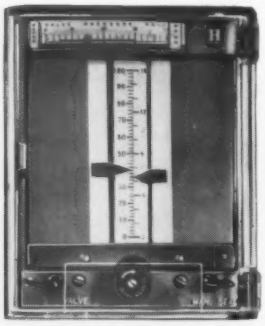
ElectroniK Pneumatic Temperature Transmitter.

Differential Converter — flow or liquid level Transmitter.

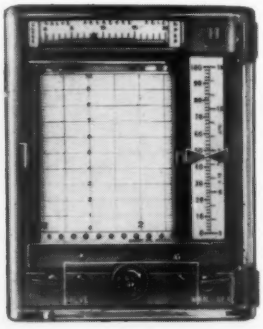
Two-Term Tel-O-Set Controller.



Tel-O-Set Indicator.



Tel-O-Set Recorder.



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. . . is a simple, flexible, formula, designed to cover all process requirements. Here are its outstanding features:

'Standard Unit' Instrumentation.
Tel-O-Set Miniature Instruments offer a common pneumatic recorder, indicator, and controller for all process variables. Each of these standard units is itself unit constructed. The 'unit' approach brings startling simplicity to the design, installation, operation, and maintenance of all centralized systems.
Separate pneumatic transmitters for most variables are within the Honeywell range; they can be used with miniature or conventional instruments.

Functional Design.
The Tel-O-Set Recorder (or indicator, chassis are interchangeable) requires a panel cut-out measuring only 5¼" × 4¾". The Quick-Connect Tel-O-Set Controller can be mounted on the back of the recorder, behind the instrument panel, or at a remote location. For graphic panels, or wherever panel space must be economically employed, the design and dimensions of Tel-O-Set Instruments offer unrivalled advantages.

Applications Unlimited.
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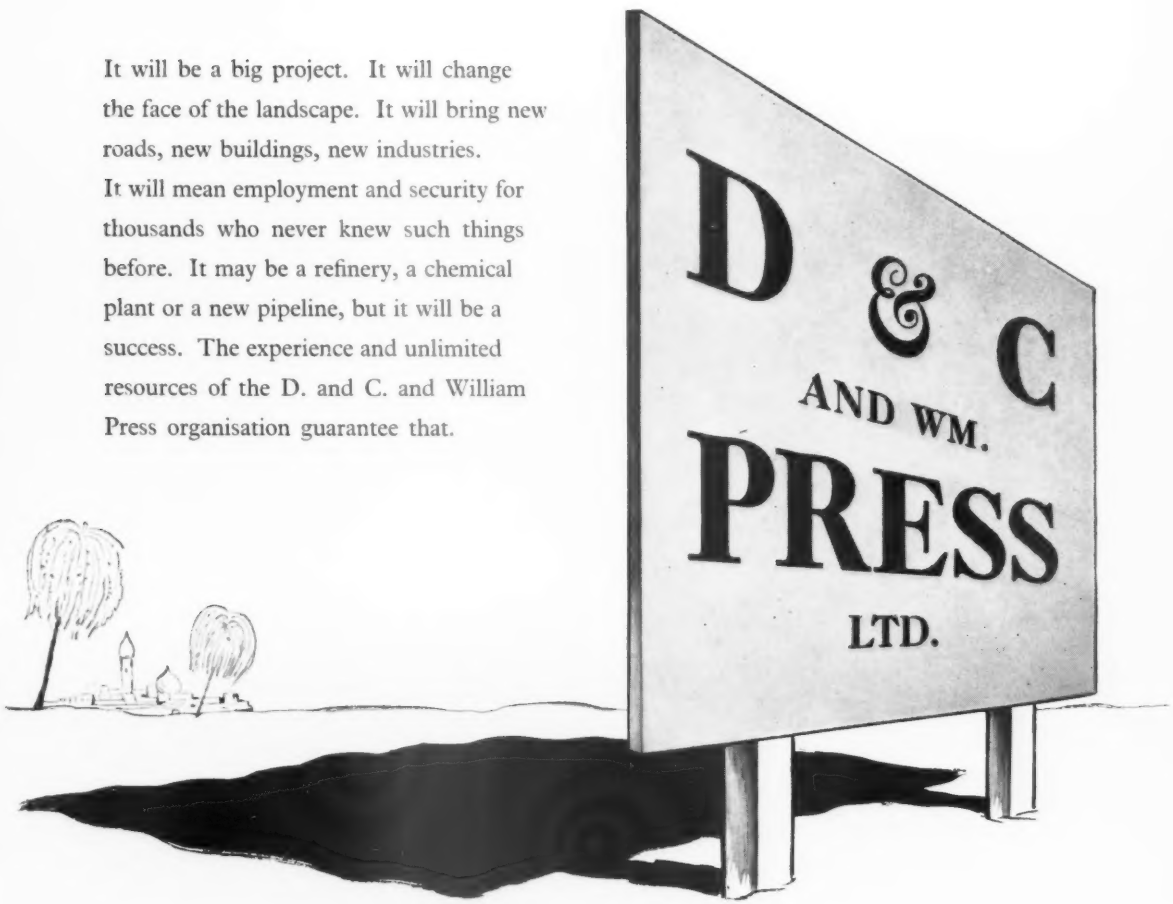

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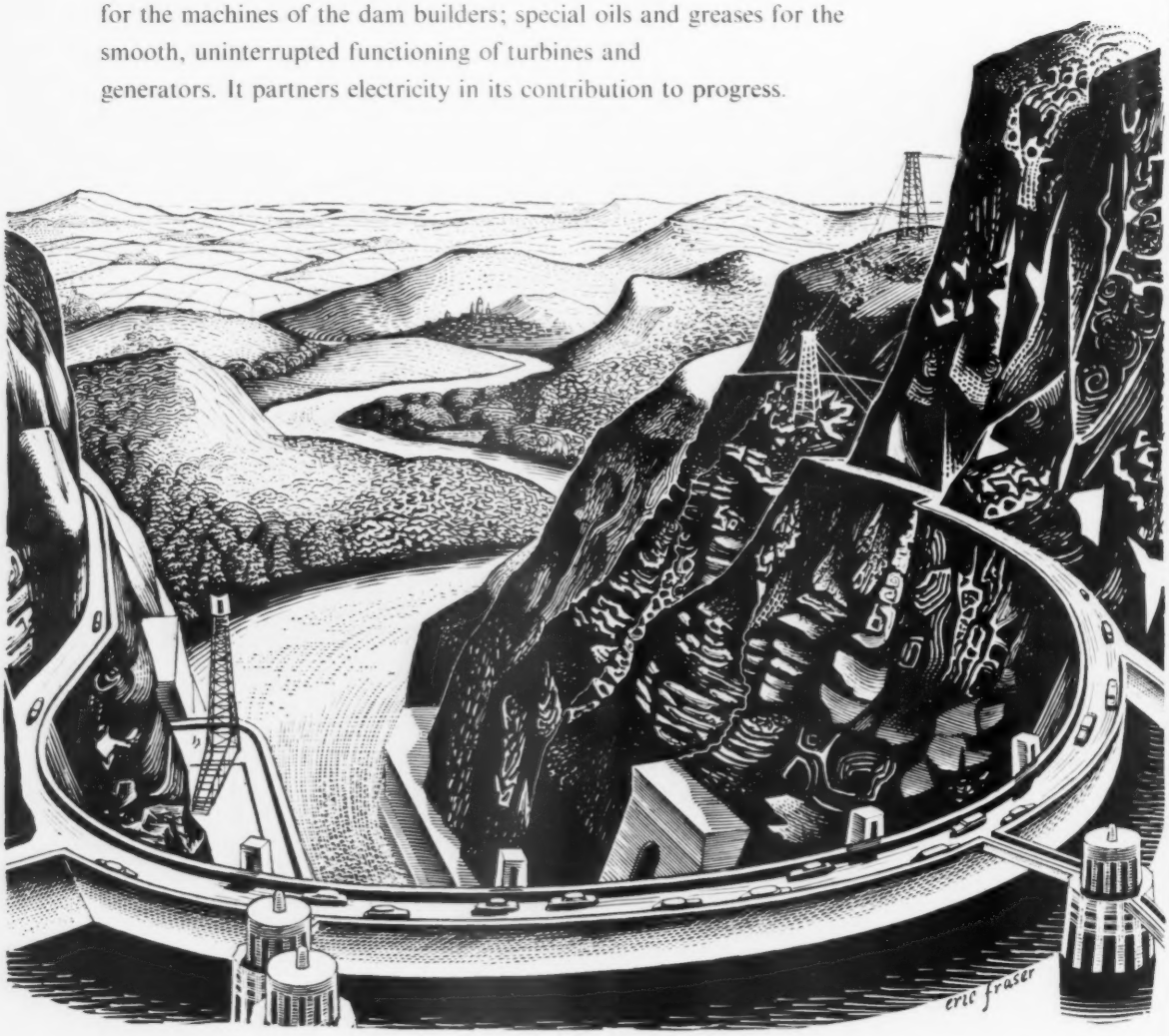

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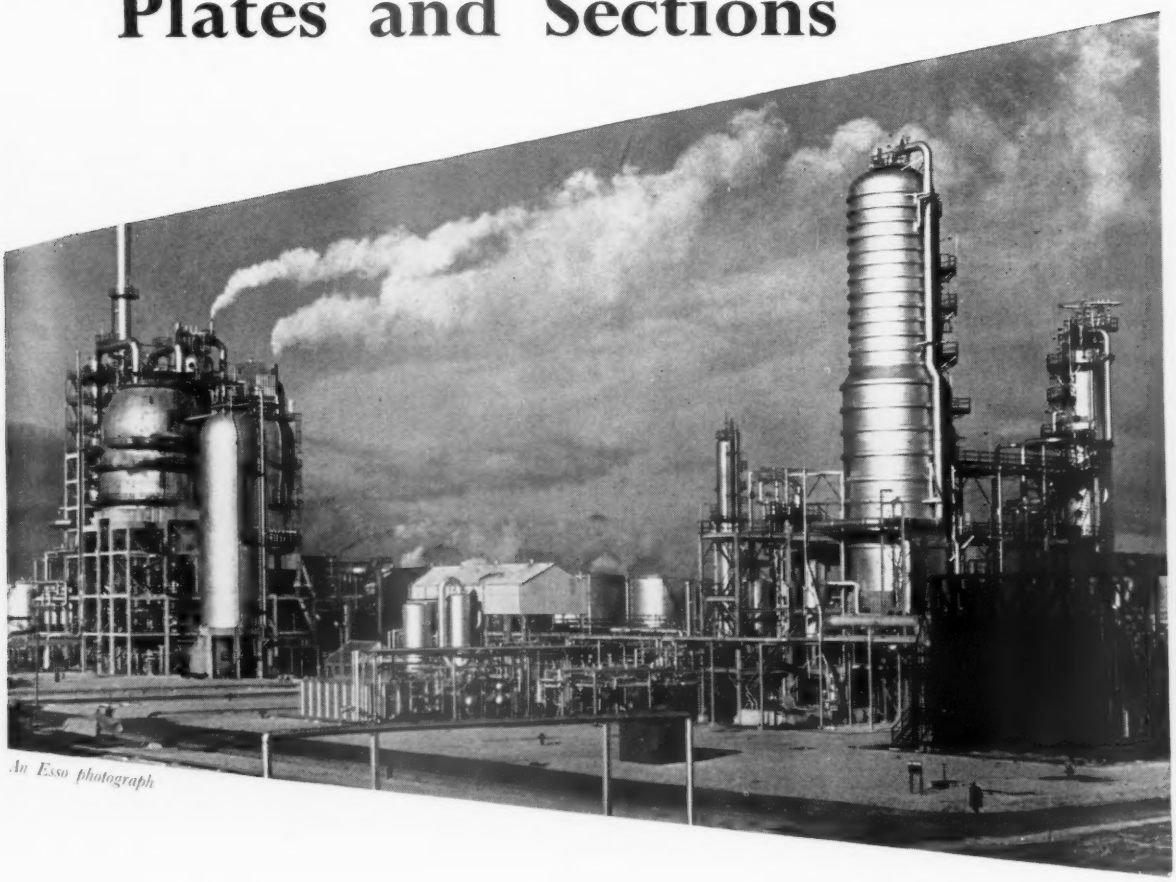

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